

Personal Computing Today

AUGUST 1982
65p

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A MICRO?**
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12 Top Machines

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OF PROGRAMS
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All You Need
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The Machines
That Matter

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OF COLOUR ON
THE VIC-20**

**SOFTWARE
CHECKLIST**
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Hundreds Of
Programs



**SINCLAIR
ZX SPECTRUM
Over The Rainbow Or
Under Par?**



ZX99

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plus P & P

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- * Business Accounts

- * Order Processing
- * Debtors Ledger
- * Tax Accounting

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Welcome to Personal Computing, a magazine designed not just for the computer experts, but for anyone with an interest in the subject of microcomputing. Even if you don't yet own a system of your own, but are still wondering which one is right for you, we think you'll find something of interest in Personal Computing.

Each month we plan to carry comprehensive information on all the personal computers on sale in the U.K. at less than £1,000 basic price. Check our FACTFILE before you buy. There you will find the machines described in a way designed to allow easy comparison between systems.

In addition we have the only real SOFTWARE CHECKLIST in print. This is our own comprehensive listing of the programs available for a wide range of machines. It will be continually up-dated and expanded, as will FACTFILE.

Software will feature strongly in our editorial in another way, with a large number of programs for you to run at home contained in each issue. These will be presented in an entirely new manner.

As well as the actual listing, there will be included within the article "How It Runs" and "Hints On Conversion" sections. These are written to help you understand how the program functions, virtually line by line, (so that you can improve your own programming techniques!) and how to convert the listing to one that will function on a different microcomputer.

Converting programs from magazines is a constant headache for the non-technical user, as there are so many machines around now, only a few printed each month will be for the particular system you happen to own. Our presentation is designed to overcome that, by outlining any special difficulties and how to overcome them.

We will be looking at commercial software, too, and plan to carry around three pages a month of software reviews in which we will be telling you the tapes to buy — and those to avoid! With literally thousands of programs on sale nowadays, there is really no way of telling the good from the bad just by reading advertisements. SOFTWARE REVIEW will help.

On the hardware side, we will be bringing you regular machine reviews, many of which will be comparative tests of similarly priced microcomputers, and will be pointing out the strengths (or otherwise) of each.

One feature we have planned that we were unable to include in the first issue is a READERS LETTERS Page!

We hope that you will be letting us know what you think of Personal Computing, be it good or bad — so long as it's printable! The greater the feedback we get from our readers, the closer we will be able to tailor the magazine to your requirements.

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SOFTWARE

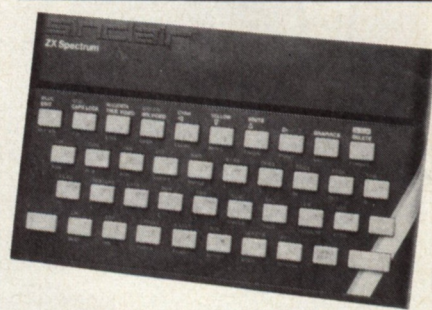
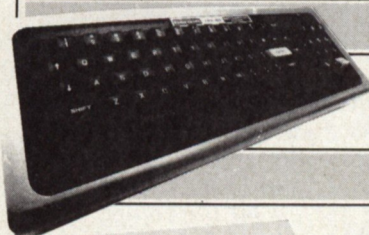
TECHNIQUE

SOFTWARE

SOFTWARE

If you would like to see your programs reach the masses through Personal Computing's pages don't hesitate to send them in. We are interested in publishing program listings and articles for any microcomputer. If you want to submit your work, please send

it to us in type-written form and include the listing, breakdown of how the program runs, the variables used, any conversion tips, and any other useful information. All listings and articles published in Personal Computing will be paid for.



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Work which you would like us to consider for publication should be sent to the Editor,

Personal Computing,
145 Charing Cross Road,
London WC2H 0EE.

Shoot out at around £200? ATARI 400 does battle in our comparative review.

PLUS
Special reports on the new Commodore machines and a programmable Dragon!

SOFTWARE

WORKING DOWN A COALMINE

No need to carry a shovel to get stuck into this unique game from M. Evans. It's different, fast and a lot of fun.

This program is written for the ZX81 with 16K of memory. It is a completely new game to be played on the home market. It is the only program that requires an Atari 400 or 800 to play the game.

The concept of the game is very simple. Coal is buried below the surface of the ground, and has to be mined. The player starts at the surface, and has to dig down to the coal. The game is played on a grid, and the player has to dig down to the coal, and then dig out the coal. The game is played on a grid, and the player has to dig down to the coal, and then dig out the coal.

Quick Reactions

Success depends on the speed of the player. The player has to dig down to the coal, and then dig out the coal. The game is played on a grid, and the player has to dig down to the coal, and then dig out the coal.

Program Changes

The program has been designed to allow for changes.

SOFTWARE

PHOTOLIBRARY

Keep computerised records of all those holiday snaps with this useful program from J.H. Bamber

Have you ever spent an hour looking for that particular holiday snap? This program will allow you to keep a computerised record of all your holiday snaps. The program is written for the ZX81 with 16K of memory. It is a completely new game to be played on the home market. It is the only program that requires an Atari 400 or 800 to play the game.

When it Runs

When the program is run, the screen will look like this:

1. Check name data in memory.
2. Check name data in memory.
3. Check name data in memory.
4. Check name data in memory.
5. Check name data in memory.
6. Check name data in memory.
7. Check name data in memory.
8. Check name data in memory.
9. Check name data in memory.
10. Check name data in memory.

YN A COALMINE

Approximately 1,000K of a program to be played on a Atari 400 or 800. It is a completely new game to be played on the home market. It is the only program that requires an Atari 400 or 800 to play the game.

HOW IT RUNS

Line by Line Description of Program

1. The program starts by clearing the screen.
2. The program starts by clearing the screen.
3. The program starts by clearing the screen.
4. The program starts by clearing the screen.
5. The program starts by clearing the screen.
6. The program starts by clearing the screen.
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9. The program starts by clearing the screen.
10. The program starts by clearing the screen.

PLUS
New feature! Games theory on computers explained in our new regular series for up and coming programmers.



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Sinclair Spectrum set to climb all over Commodore?

Must be the time of year. A young man's mind turns to thoughts of love, and computer companies launch new models...

In the wake of 'Uncle Clive' Sinclair's Spectrum, **Acorn** and **Commodore** are muttering things about machines meant to compete with the multi-coloured menace. Acorn have not long since produced a BBC BASIC for their Atom, making it a powerful little machine in its own right. The set of memories costs £45 and is plugged into the PCB, whereupon the Atom can be switched between its own, slightly odd language, and the new BASIC.

Make sure you have plenty of memory, though. We heard recently of the apparent confusion over **BBC machines** and their memory. Although the BBC Micro has marvellous graphics capabilities, the most usable of them takes 10K of the user's program memory! Since the operating system of the machine itself takes another 3K, on the model A you get left with about 2.7K to put programs into! -16K become less than 3K.

Nice graphics, shame about the space?

Electron

Acorn's new machine will be termed the '**Electron**' (someone down there has a thing about small particles, obviously), and is designed to compete directly with the Spectrum.

It will be equipped with BBC BASIC, 32K RAM and a high definition screen. This needs 8K to

run, so drop that 32K to 24K. We can get no work as to the size of the operating system, or whether it too will be nibbling away at the users program space. If so we hope they tell us about it this time!

The Electron will also be possessed of a dual-speed cassette and a programmable sound generator. Acorn themselves, curiously, will neither confirm or deny details of the Electron, but sources very close to the company put the launch date somewhere in August and the price around £130. Perhaps they're just trying to worry Clive a little. After all, he's worried everyone else long enough!

Not-So-New Brain

Another launch is that of the **Newbrain** portable computer. Re-launch would be more appropriate as those of you with long memories will remember that it was launched once before, two years ago.

Grundy Business Systems have 'acquired' the project from Newbury and are giving it another try.

There are many improvements on the 'new' Newbrain — memory is expanded to 32K from 2K, for example. Up to Four 512K RAM packs can be connected to the Newbrain, giving a phenomenal 2 MB capability! (Perfect for big program nuts!). As well as the memory packs, the Newbrain will take cassettes, drive a TV or monitor and expand to handle discs and printer.

Because of its small size the Newbrain would appear ideal for educational, office or laboratory use, as well as in the living room. It

will be sold in two models, the 'A' and 'AD', without and with built-in fluorescent display at £199 and £299 respectively. We hope to get hold of a Model A for review in PC very soon but if you can't wait, **Grundy** reside at **Cabridge Science Park, Milton Road, Cabridge. Tel: 0223 350355.**

PET Panic

We hear (ever-so-quietly) that there was indignation and panic in the halls at Commodore, following Uncle Clive's launch recently. Much gnashing of teeth and growling at press officers, apparently.

Seems the great home of the PET was caught a little napping by the Spectrum and woke up with a start. They had planned to produce a baby VIC, the **VIC-10**, sometime this autumn, but rumour has it that they may well knock that on the head now that they are faced by the Spectrum. Early specifications would suggest that, as a computer, Clive's machine would slaughter it!

Commodore do have the **64** up their sleeves, however, and if rumours from the States are correct, then this could be a major release. It has a built-in BASIC and 38K of RAM available to the user. The interesting thing is, though, that the BASIC is switchable, supposedly to a socket on the machine. Commodore's idea would be that 'modules' could then be marked which plug into the 64 and allow it to behave, for all intents and purposes, like another micro! Thus anybody else's software could be used! True independence at last! Hardware, at that point, becomes totally irrelevant and you can take your pick of any programs on the market!

With true big-company power, Commodore can't even decide what to call it... it might yet appear as the Vic-40! Whatever name actually gets put on the box, the 64 sounds an amazing machine. It is due to be launched in September at the moment, but you never can tell — anything might yet happen! Price around £400.



Dixons and VIC

Whilst on the subject of **Commodore, Dixons**, that well known cross between a chemist and a hi-fi shop, are now marketing the **VIC-20** through their 250 high street outlets. Some £150,000 is being spread across an advertising campaign.

People who begin marketing computers always seem compelled to predict how many units will be in how many homes, and by what year.

Dixons estimate is a little on the conservative side at one million by end of 1985, (UK).

What with **Electrons, Spectrums, BBC boxes** et al, we could be well past that — and an awful lot sooner. But as we're not marketing computers, we're **not** going to make a prediction.

Acorn Adds And 81 Keys

Since the **Atom** is such a versatile little beast, it has a wide range of improvements available for it on ROM (Read Only Memory). The snag is, or used to be, that there aren't enough holes in the PCB to plug them all into.

A clever little adaptor has been released by **CMT Computer Technology, 6 Turf Park Road, Royton, Oldham Lancs.** It costs £22 and will allow up to four ROM packages to connect to one socket. A simple POKE command will tell the machine which of the four you want. Neat, that.

Also, recently out is yet another keyboard for the ZX81. This one is easier to fit than most, and somewhat tidier. You just peel off

the existing keyboard (!?!) and drop this one in its place. A short piece of ribbon cable completes the connections.

The kit is marketed by **Kempston Electronics, 60 Adamson Court, Hillgrounds Road, Kempston, Bedford.** It will cost you £22.50 complete.

Some Softspots

News of some recent program releases. For the ZX81 there is a handsome Chess game from **Artic, 396 James Reckitt Avenue, Hull, North Humberside.** It is claimed to offer a good game and costs £45. Graphics are described as 'excellent'. Artic are also producing a FORTH ROM, which enables the ZX81 to run that somewhat up-market language. FORTH is a strange thing to use — you create you own instructions as you go. (There are no rules, really!)

FORTH programs written by anyone other than you are well-nigh impossible to comprehend. If you

fancy solitaire computing, FORTH costs £60.

Also, for **Sinclair's** is a series of tapes entitled 'Bargain Bytes' each costing around a fiver. Each will carry eight programs and run on a 16K machine. Number One contains a couple of Adventure games and a Bank Accountant, amongst others. The company is called **Shepard Software, 22 Green Leys, Maidenhead, Berks,** and price includes p&p.

The **VIC-20** gets some serious intentions with a database management program from a company called **Stage One.** If you need to ask what a database manager is, you don't need one. To run it, you **do** need 16K, discs and printer. Stage One can be conversed with on **Poole 735656.**

Talking of serious matters, there is now a company marketing a device called Safeware. This will allow you to protect your programs from being copied or used without your permission.

The idea is that somewhere in the program being guarded there is a little routine which looks at the user port socket (on a PET at present) to see if a particular piece of hardware is hanging there. The hardware comes with the package and is individually coded for each user. No package, no run program.

Safeware costs £19.95 from **Mektronic Consultants, Linden House, 116 Rectory Lane, Prestwich, Manchester.**

Clubbed on the End

To round off this month, news of a new computer club springing up. . . **The Norwich and District BBC User Group** is based at **Room B12a, Norwich City College of Further Education, Ipswich Road, Norwich** (where else?) **Norfolk.** Knock twice and ask for Paul Beverly. Membership costs £2, discounted to £1 for students and OAPs.



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THE BEST SOFTWARE (BY VARIOUS AUTHORS) AT LOW PRICES

QUOTES

"Michael Orwin's £5 Cassette Two is very good value. It contains 10 stolid well designed games which work, offer plenty of variety and choice, and are fun." from the ZX Software review in *Your Computer*, May '82 issue

"I had your Invaders/React cassette . . . I was delighted with this first cassette." P. Rubython, London NW10

"I have been intending to write to you for some days to say how much I enjoy the games on 'Cassette One' which you supplied me with earlier this month." E. H., London SW4

"... I previously bought your Cassette One and consider it to be good value for money!" Richard Ross-Langley Managing Director Mine of Information Ltd.

CASSETTE 1 (eleven 1k programs)

machine code:
React, Invaders, Phantom aliens, Maze of death, Planet lander, Bouncing letters, Bug splat.
Basic:
I Ching, Mastermind, Robots, Basic Hangman PLUS Large screen versions of Invaders and Maze of Death, ready for when you get 16k.
Cassette One costs £3.80

CASSETTE 2 Ten games in Basic for 16k ZX81

Cassette Two contains Reversi, Awari, Laser Bases, Word Mastermind, Rectangles, Crash, Roulette, Pontoon, Penny Shoot and Gun Command.
Cassette Two costs £5

CASSETTE 3 8 programs for 16k ZX81

STARSHIP TROJAN



Repair your Starship before disaster strikes. Hazards include asphyxiation, radiation, escaped biological specimens and plunging into a Supernova.

STARTREK This version of the well known space adventure game features variable Klingon mobility, and graphic photon torpedo tracking.

PRINCESS OF KRAAL An adventure game.

BATTLE Strategy game for 1 to 4 players.

KALABRIASZ World's silliest card game, full of pointless complicated rules.

CUBE Rubik Cube simulator, with lots of functions including 'Backstep'.

SECRET MESSAGES This message coding program is very txlp qexi jf.

MARTIAN CRICKET A simple but addictive game (totally unlike English cricket) in machine code. The speed is variable, and its top speed is very fast.

Cassette 3 costs £5

CASSETTE 4 8 games for 16k

ZX-SCRAMBLE (machine code)



Bomb and shoot your way through the fortified caves.

GUNFIGHT (machine code)



INVADERS (machine code)



GALAXY INVADERS (machine code)
Fleets of swooping and diving alien craft.

SNAKEBITE (machine code)
Eat the snake before it eats you. Variable speed (very fast at top speed).

LIFE (machine code)
A ZX81 version of the well known game.

3D TIC-TAC-TOE (Basic)
Played on a 4x4x4 board, this is a game for the brain. It is very hard to beat the computer at it.

7 of the 8 games are in machine code, because this is much faster than Basic. (Some of these games were previously available from J. Steadman).

Cassette 4 costs £5

FUNGALOID (Machine code)

Recorded on quality cassettes, sent by first class post, from:

Michael Orwin, 26 Brownlow Road, Willesden, London NW10 9QL (mail order only please)

Don't let its size fool you.

If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of under £200 excluding VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.

NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.

Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

NO OTHER MICRO HAS THIS MUCH POWER IN THIS MUCH SIZE FOR THIS MUCH MONEY.



So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

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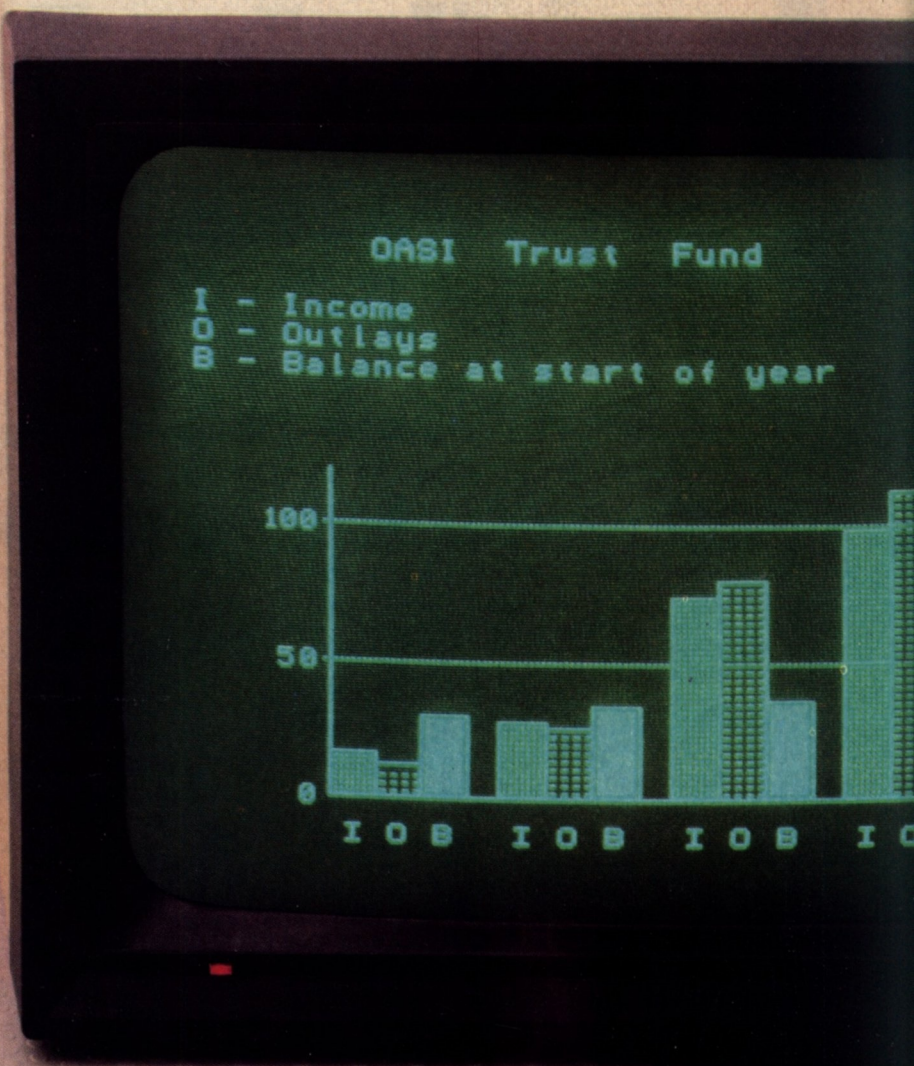
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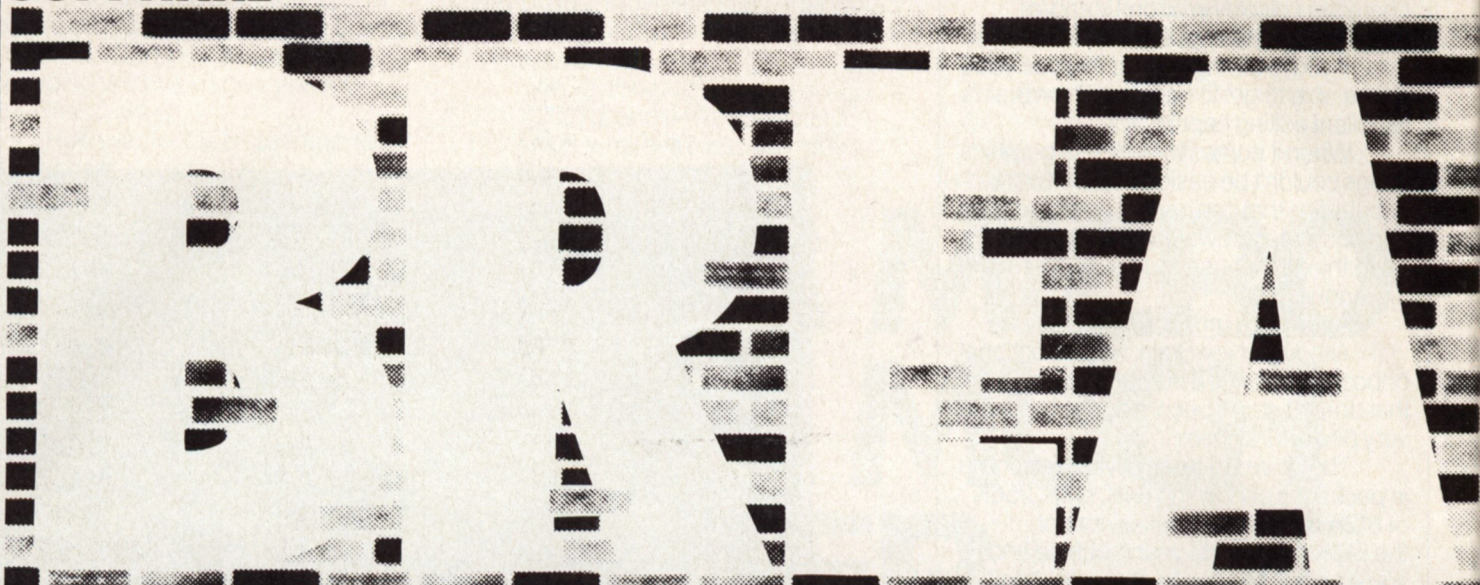
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NEWBRAIN



A good demonstration of your VIC-20's power in this exciting and skilful version of the ever popular arcade game. Lots of room for adding your own ideas too!

This version of one of the original computer games makes good use of the colour and music capabilities of the VIC. It is very simple to play. You have nine balls at the start of the game and as long as you manage to bounce the ball off the slide at the bottom of the screen, the ball will stay in play. If you find this easy, try it with two balls (or two slides) at

once, or vary the number of bricks. Each time you miss the ball, your ball count (top left hand corner of the screen) is reduced by one. Each time the ball count changes, your score changes too.

Scoring Hints

You score every time you destroy one of the coloured bricks

at the top of the screen. One other suggestion to improve the game is to get rid of the 'white' bricks (which can't be seen) at the start of the game. Again you can improve the scoring system by relating the score to the colour of the brick, or make the sound of hitting a brick change according to its colour. Alternatively, you can get the ball to change colour at random.

HOW IT RUNS

Structure Of The Program

Line 5: Sets volume at maximum.
 Lines 20 to 29: One bounce.
 Lines 30 to 39: The other bounce.
 Line 50: Sets score to zero, ball number (Z) to nine.
 Lines 60 to 80: Place the bricks at the top of the screen.
 Line 110: X and Y control the direction of the ball.
 Lines 120 and 130: Place the ball (A and B) and set indicators (M and N) to POKE the ball out of its old position.
 Line 160: Goes to bounce routine.
 Line 162: Goes to 'new ball' routine.
 Line 180: Bounce routine.
 Line 200: A brick has been struck.
 Lines 300 to 330: POKEs and unPOKEs to move the slide.
 Lines 340 to 360: Get player commands to move the slide.
 Lines 400 to 505: Move the ball.
 Subroutine from 2000: Changes direction of ball (2000), checks if ball has hit bat (2005) and if it has, sends action back to main body of program, changes (rather noisily) the ball count (2010 to 2023) and checks that ball count is not zero (2025).
 Subroutine from 5000: Makes the brick disappear, produces some appropriate sound effects (5002 to 5004), updates the score (5005).

```
1 REM BREAKOUT
5 POKE36878,15
10 GOT040
20 X=-X
22 POKE36876,200
29 RETURN
30 Y=-Y
32 POKE36876,220
39 RETURN
40 PRINT"Q"
50 SC=0:Z=9
60 FORJ=23T0109STEP 3
70 POKE 7680+J,102
75 POKE38400+J,(INT(RND(1)*8))
80 NEXT
90 F=10
110 X=-3:Y=1
120 A=20:M=A
130 B=1:N=B
160 IFA<0 THEN GOSUB 20
```


HINTS ON CONVERSION

The VIC is named after the special chip it contains (the Video Interface Chip). As this is unique to the VIC (and its other Commodore relatives) there are several commands in this program which will have to be altered or removed to make Breakout function on other systems. All POKE commands which are between 36874 and 36878 control the sound generating section of the VIC computer.

For example, Line 5 sets the volume to its maximum value, Lines 22, 32 and 2022 generate a sound — the number after the comma determines whether high note or low.

The command in Line 5003 works in much the same way, except that it generates a noise rather than a musical note. If the value after any of these POKE commands is 0 it simply turns the sound off.

The VIC has a memory mapped screen for graphics, like many other common systems, but its organisation is somewhat unusual. There are two sets of screen addresses to be handled, the first (from 7680 to 8185) is the 'character' screen and the second (38400 to 38905) is the 'colour' screen. This means that any value POKEd to the character screen can be made to appear in any colour by POKEing the appropriate colour value to the corresponding 'colour' screen location. Program lines 300 to 330 and 400 to 505 show this.

The POKE codes used correspond to;

32 Space
42 Asterisk
102 Cross hatched square

PROGRAM LISTING

```
162 IF A>20 THEN GOSUB2000
165 A=A+X
180 IF B<1 OR B>20 THEN GOSUB 30
185 B=B+Y
200 IF PEEK(7680+22*A+B)=102 THEN GOSUB 5000
300 POKE8163+F,32
310 POKE 8165+F,32
320 POKE 8164+F,102
330 POKE38884+F,0
340 GETA$
350 IF A$="Z" THEN F=F-1
360 IF A$="M" THEN F=F+1
400 POKE 7680+22*M+N,32
500 POKE 7680+22*A+B,42
505 POKE38400+22*A+B,0
510 POKE36876,0
910 M=A:N=B
920 GOTO160
2000 GOSUB20
2005 IF ABS(F-B)<2 THEN RETURN
```

```
2010 Z=Z-1
2015 PRINT"BALL"Z
2020 FORT=1T020
2022 POKE36876,128+4*T:POKE36876,0
2023 NEXT
2025 IFZ=0 THEN 6000
2030 RETURN
5000 POKE 7680+22*A+B,32
5001 POKE36876,0
5002 FORT=1T010
5003 POKE36877,255-10*K:POKE36877,0
5004 NEXT
5005 SC=SC+367
5010 PRINT"BALL"Z" SCORE"SC
5020 GOSUB20
5500 RETURN
6000 POKE36876,0
6005 PRINT"END "
6010 GOTO6010
```


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EASY LINE INPUTS

At last! An easy way for TRS-80 owners to input data and word processing! A little routine from S.A. Barnett which is worth its weight in keyboards!

As all TRS-80 users know, unless you have disk BASIC, you cannot input a line containing a comma. Any program using large amounts of data input usually requires such a routine, and it is essential to any form of word processing in BASIC. To this end, this short routine only

uses about 180 bytes with all of the spaces removed. It supports backspace and line delete. Any other control key will end the routine.

On exit 'B\$' contains the input string.

```

5 PRINT CHR$(24)
10 A$=INKEY$: IF A$=" " GOTO 10
20 A = ASC(A$):IF A<31 GOTO 40
30 PRINT A$; :B$ = B$ + A$:GOTO 10
40 IF A = 8 THEN PRINT A$; :A$=LEFT$(B$,LEN(B$)-1): B$ =
  A$:GOTO 10
50 IF A = 24 THEN B$=" ":PRINT CHR$(29);CHR$(30); :GOTO
  10
60 RETURN

```

Program Notes

Line

```

5 PRINTCHR$(24) TURNS ON THE CURSOR
10 INKEY$ CAN BE REPLACED BY 'GET' ON THE PET.
20 ALL ASCII CODES BELOW 31 ARE CONTROL CODES ON
  THE TRS-80.
30 PRINT THE CHARACTER AND ADD IT TO THE STRING.
40 ASCII CONTROL CODE '8' IS A BACKSPACE.
50 ASCII CONTROL CODE '24' IS A (SHIFT) BACKSPACE,
  WHICH MEANS 'DELETE THIS LINE' ON THE TRS-80.
50 PRINT CHR$(29) PLACES THE CURSOR AT THE
  BEGINNING OF THE CURRENT LINE.
  CHR$(30) DELETES TO THE END OF THE LINE.

```

Microspots are our regular "quick-action" program hints. They are designed to be short, useful and adaptable. However, they are not necessarily aimed at the complete beginner and therefore we advise readers to read through each very thoroughly before attempting to enter and use the program. We will pay £20 for each Microspot submitted by readers that makes it into print! Address your envelope to "Microspot, Personal Computing, 145 Charing Cross Road, London WC2H 0EE". Keep 'em short and keep 'em coming!

SOUNDING OFF ON THE BBC MICRO



**In this exclusive excerpt
from his forthcoming book
“Let Your BBC Micro
Teach You To Program”
Tim Hartnell not only gives
us an insight into making
music with micros, but
also provides programs
for BBC men to run**

The SOUND statement on the BBC Microcomputer is very versatile. It is easy to use, and if you avoid the use of ENVELOPE the first few times you use the SOUND command, you should find it very easy to master. Even without ENVELOPE, you'll find there is a wide variety of sounds you can make to incorporate into your programs.

The word SOUND is followed by four parameters. The first one (0 to 3), chooses the sound channel, the second (0 to -15) sets the volume, with -15 being the loudest, the third chooses the pitch of the note (0 to 255) and the fourth controls its duration (1 to 254). A simple, one-line program which puts the sound output through its paces indefinitely, producing a sort of electronic music, is:

```
10 SOUND RND(4) - 1, - RND(15), RND(255), RND(20) : GOTO 10
```

We can demonstrate the statement in action more precisely with the following routine, which sets the volume at maximum (-15) and the duration at one. Enter and run this program to hear it in action. You can read the channel number (the left hand column) and the

pitch value (the right hand column of figures) as the program runs.

```
10 REM Sound Demo 1
20 VOLUME = -15
30 DURATION = 1
40 FOR CHANNEL = 0 TO 3
50 FOR PITCH = 1 TO 255 STEP 3
60 SOUND CHANNEL,VOLUME,PITCH,DURATION
70 PRINT CHR$(128 + RND(6));CHANNEL,PITCH
80 NEXT PITCH
90 NEXT CHANNEL
```

You'll see (or hear) that the first run, when CHANNEL is set to zero, produces a strange sound, quite unlike the music produced when the CHANNEL is one, two or three. This is because the channel zero is for noise, and the other three allegedly for music. The rising tone produced on channels one, two and three is, I'm sure you'll agree, quite effective.

Using A Loop

You can change this by putting the volume in a loop to produce a totally different sound. Try to predict what this routine will produce before you run it. You're almost certain to be wrong. Modify the first program given, by adding lines 55 and 75, and changing lines 50 and 70 as indicated.

```
20 REM Sound Demo 2
30 DURATION = 1
40 FOR CHANNEL = 0 TO 3
50 FOR PITCH = 1 TO 100 STEP 3
55 FOR VOLUME = -15 TO -1
60 SOUND CHANNEL,VOLUME,PITCH,DURATION
70 PRINT CHR$(128 + RND(6));CHANNEL,VOLUME,PITCH
75 NEXT VOLUME
80 NEXT PITCH
90 NEXT CHANNEL
```

If all went well, you should have heard a strange series of cymbal-like sounds, followed by notes played on a rather flat piano.

There is, of course, no reason why even random noise should not be musical. The following routine, Storm Boy, produces music which, although somewhat atonal, is certainly better than the mishmash of noise produced by the one-line routine at the start of this article.

```
10 REM *Storm Boy*
20 REPEAT
30 VOLUME = -10 - RND(5)
40 CHANNEL = RND(3)
50 PITCH = RND(8) * 30
60 DURATION = 2 * RND(10)
70 SOUND CHANNEL,VOLUME,PITCH,DURATION
80 PRINT CHR$(128 + RND(6));CHANNEL,PITCH
90 UNTIL FALSE
```

The SOUND statement can also produce quite creditable sound effects, such as the following:

```
10 REM *Steam Train*
20 K = -15
30 REPEAT
40 SOUND 0,K,100,6
50 SOUND 1,K,120,5
60 SOUND 2,K,140,4
70 SOUND 3,K,160,3
80 T = TIME
90 REPEAT UNTIL TIME - T > 30
100 K = K + 0.5
110 UNTIL K = 0
```

Experimentation is the only way to discover how wide the range of this command can be!

Stacking Notes

You will find, from time to time, that sounds tend to continue after the line which generated them has long been passed. The computer, when necessary, stacks up notes and waits for the sound channel to clear so it can play them. If you want a note to be played immediately, in effect to dismiss the notes stacked up waiting for their turn, you can use a slightly more elaborate form of the SOUND statement.

The computer can stack up to four notes at a time, and the full SOUND statement can tell it how many notes you wish to play. The statement, in its full version, is as follows: SOUND &HSFC, volume, pitch, duration.

The first parameter after the ampersand, H, can have a value of 0 or 1. In general use, it is set to 0. It has a specific task when used in conjunction with the ENVELOPE statement. For your use in the early stages, you should assume it is set to 0. The second parameter, S, dictates the number of notes which are to be sounded at once S can equal 0, 1, 2 or 3, and when set to zero, allows the notes to be played one at a time, in turn. This is the way the SOUND statement operates in its simpler form.

The third parameter, F, can be set to equal 0, when the SOUND statement operates as normal, accepting the notes in the order in which they are stacked. If F is set to 1, all the waiting notes are suppressed, the note which is sounding is cut off, and the newest note is sounded. C stands for channel, the voice we used in the earlier section of this article. It is set to 0, 1, 2 or 3.

The SOUND statement, then, is fairly easy to use, although it can, as you have seen (and heard), produce quite exotic effects. Finally, the following program is a great demonstration of how effective the SOUND statement can be.

```
10 REM *Piano dementia*
20 MODE7
30 FOR J = 255 TO 0 STEP -1
40 SOUND 17, -15,J,1
50 PRINT CHR$(128 + RND(6));CHR$(157);
60 NEXT J
70 FOR J = 0 TO 255
80 SOUND 17, -15,J,1
90 NEXT J
100 REPEAT
110 A = RND(47) + 43
120 M = -53 * (A = 90) - 61 * (A = 88) - 69 * (A = 67) - 73 *
(A = 86) - 81 * (A = 66) - 89 * (A = 78) - 97 * (A = 77) - 101 *
(A = 44)
130 IF M = 0 THEN 110
140 PRINT CHR$(128 + RND(6));CHR$(157);CHR$(128 + RND(6));
M,M,M
150 FOR J = -15 TO -1 STEP RND(3)
160 SOUND 1,J,M,RND(3)
170 SOUND 2,J,M,RND(5)
180 NEXT J
190 UNTIL RND(10) = 1
200 PRINT CHR$(128 + RND(6));"#####"
210 FOR J = -15 TO -1
220 SOUND 1,J,53,5
230 NEXT J
240 FOR J = 1 TO 255 STEP RND(10)
250 SOUND 17, -15,J,2
260 SOUND 18, -15,255 - J,2
270 SOUND 19, -15,J/2,2
280 PRINT CHR$(128 + RND(6));CHR$(157);
290 NEXT J
300 GOTO 30
```




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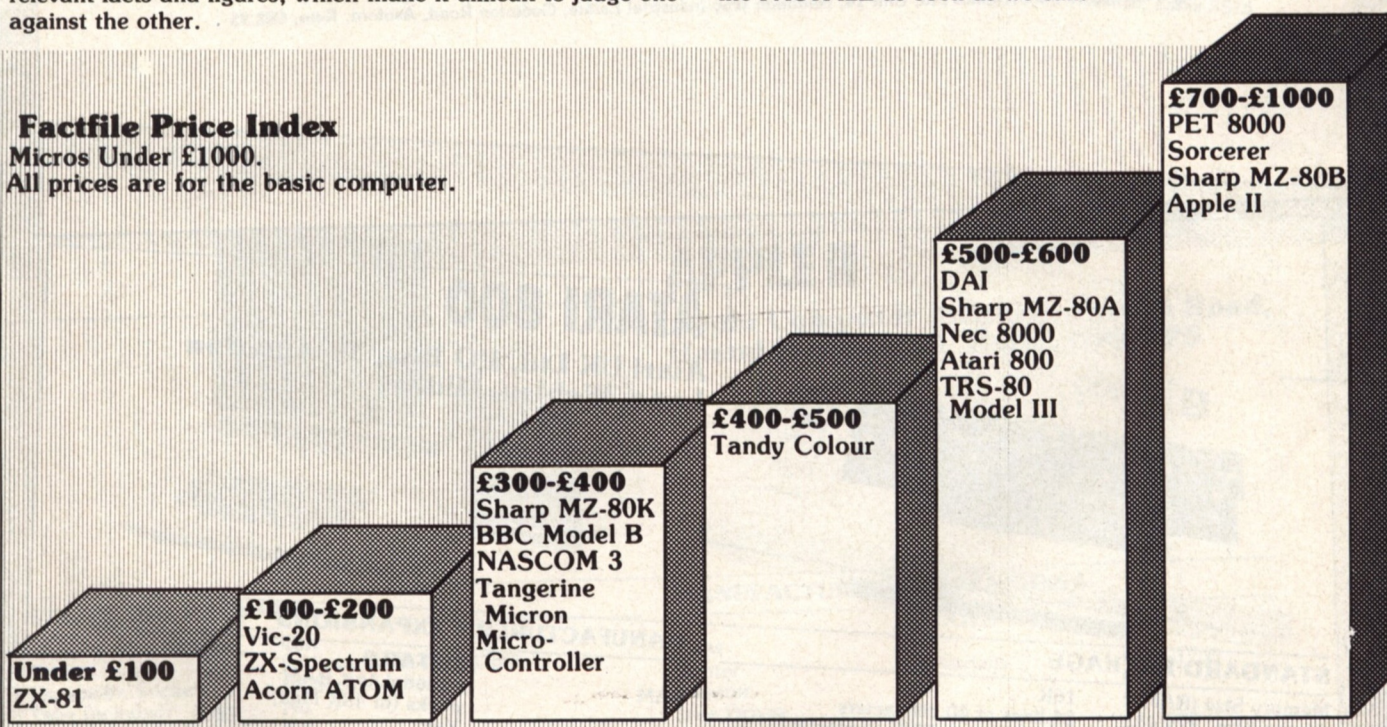
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Factfile Glossary

RAM: Stands for Random Access Memory and it is in there to accept the user's programs. Amount of memory is measured in "thousands of bytes" or "K" ie, 8K. A byte is a computer 'word' or single piece of information, made up of eight 'bits' which are just 1 or 0. Hence you need thousands of bytes to store a reasonable size program, since each letter, number, full stop, comma, line number, etc, uses up computer 'words' quite rapidly.

As a guideline - you can get about 50 program lines into 1K and 250 into 8K. This is a rough estimate - don't take it literally! The figures are not straight multiples, because you need to allow the machine space to work on your listing, once you've typed it in.

ROM: Read Only Memory. The machine can look see what is stored in the memory, but it cannot alter the contents, nor store anything new. Generally used for control programs, where the micro consults the memory to see what to do next at various points in the program. Languages, such as BASIC, are stored in ROM and allow the machine to interpret what you type in, in terms of its own 'machine code'.

SIZE OF BASIC: The number of bytes occupied by the BASIC language is important, as it is an approx. guide to the BASICs versatility. The more powerful is the language, the easier it should be to use.

BUS CONNECTION: A socket on the micro which allows it to be linked up to various add-on etc. This can take the form of many various items, ie, expansion box, printer, disc drives, plotting device. In short a BUS is an information 'window' through which the micro communicates with the outside world.

SERIAL/PARALLEL OUTPUT: This refers to the manner in which the micro transmits data to other units. If it puts out information in a long string, one bit after another, down a single wire or connector, it is a serial output. Parallel output is where pins or wires carry information simultaneously and are 'read' together as a block by whatever it is the micro is communicating with.

VIDEO OUTPUT: an output which will drive a monitor, as opposed to a TV set, allowing it's use as a screen for the computer.

FACTFILE REFERENCE



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Atari UK Ltd, PO Box 59, Alperton Lane, Wembley, Middx.

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STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	24 lines of 40 characters
Expansion Sockets	Serial output, BUS connector
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	£599.95

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Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	TBA

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STANDARD PACKAGE

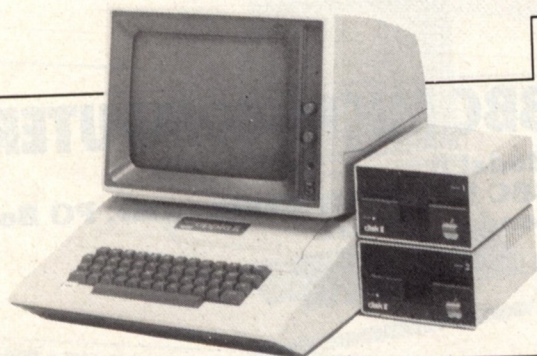
Memory Size (RAM)	2K
Screen Size	16 lines of 32 characters
Expansion Sockets	BUS connector, Printer, Video output
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	£140 kit, £174.50 built

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STANDARD PACKAGE

Memory Size (RAM)	48K
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Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8 or 12K
Average Price	£812

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes various	£200-1700
Monitor	Yes	£134
Disc Drives	Yes	£379
Other Languages	Yes	£84-500
Multi-user	No	—
Capabilities	Yes	£26
BASIC extensions (Toolkits)		

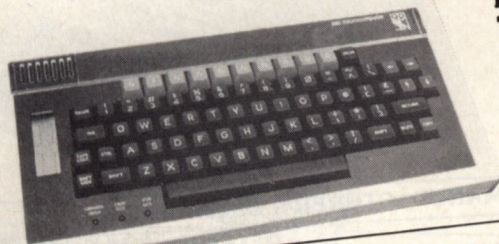
OTHER ADD-ONS:

TMS 5100 Talking Board, GM Microtronics Ltd, Unit 14, Godinton Way Industrial Estate, Godinton Road, Ashford, Kent, £82.95; **Multifunction Card**, Datex Micros, 193 Touring Road, Worthing, W. Sussex, £85; **5 1/4" Winchester disc drive**, Independent Computer Engineering Ltd 16/18, Littleton Road, Ashford, Middlesex, TW15 1UQ; **16K RAM Board**, DDP Research & Marketing, 17 Novel Square, Basildon, Essex, SS13 1LP, £75; **U-port, 8 serial interfaces**, U-Microcomputers, Ltd, Winstanely Industrial estate, Long Lane, Warrington, Cheshire, WA2 8PR, £195.

FACTFILE REFERENCE

BBC MICROCOMPUTER

Model A.
BBC Microcomputer Systems, PO Box
7, London W3 6JX.



STANDARD PACKAGE

Memory Size (RAM)	16
Screen Size	32 lines of 40 characters (max)
Expansion Sockets	Parallel serial output, analogue output, Bus connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	16K
Average Price	£299

MANUFACTURER'S EXPANSIONS

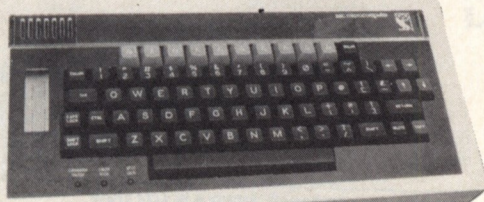
	DETAILS	PRICE £100
RAM	up to 32K	—
Printer	TBA	—
Monitor	No	—
Disc Drives	TBA	—
Other Languages	TBA	—
Multi-user	Yes	—
Capabilities	TBA	—
BASIC extensions (Toolkits)		

OTHER ADD-ONS:

Disc drives, single and dual, Cumara Ltd, 35 Walnut Street Close, Guildford, Surrey GU1 4UN, Tel: 0483 50321, £199-799; **BBC Cassette Recorder,** Microage Electronics, 135 Hale Lane, Edgware, Middx, £28; **Colour Monitor,** Portatel Conversions Ltd, 25 Sunbury Cross Centre, Staines Roach West, Sunbury-on-Thames, Middx, TW16 7BB, £299; **Floppy Disc Controller Kit,** Midwich Computer Co Ltd, Newitt House, Northgate Street, Bury St. Edmunds, Suffolk IP33 1HQ, £42.50.

BBC MICROCOMPUTER

Model B
BBC Microcomputer Systems, PO Box 7,
London W3 6JX



STANDARD PACKAGE

Memory Size (RAM)	32
Screen Size	30 lines of 80 characters
Expansion Sockets	Serial and parallel output, analogue output, printer BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	16K
Average Price	£399

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	TBA	TBA
Monitor	No	—
Disc Drives	TBA	TBA
Other Languages	TBA	TBA
Multi-user	Yes	—
Capabilities		
BASIC extensions (Toolkits)	TBA	TBA

OTHER ADD-ONS:

Disc drives, single and dual, Cumara Ltd, 35, Walnut Tree Close, Guildford, Surrey GU1 4UN, Tel: 0483 503121, £199-799; **BBC Cassette recorder,** Microage Electronics, 135 Hale lane, Edgware, Middx, HA8 9QP, £28; **Colour Monitor,** Portatel Conversions Ltd, 25 Sunbury Cross Centre, Saires Road West, Sunbury-on-Thames, Middx, TW16 7BB, £299; **Floppy Disc Controller Kit,** Midwich Computer Co Ltd, Hewitt House, Northgate Street, Bury St. Edmunds, Suffolk, IP33 1HQ, £42.50; **Carrying Case,** CJE Microcomputers, 25 Henry Avenue, Rustington, W. Sussex, BN16 2PA, £18.50.



COMMODORE PET 4000

Commodore, 675 Ajax Avenue, Slough, Bucks

STANDARD PACKAGE

Memory Size (RAM)	16 or 32K
Screen Size	25 lines of 40 characters
Expansion Sockets	IEEE 488 standard, parallel output
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	12K
Average Price	£632.50, £799.25

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes several	£454-1604
Monitor	N/A	—
Disc Drives	Yes	£396
Other Languages	Yes, single or dual	£454-1029
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Universal Interface, Technomatic Ltd, 17 Burnley Road, London NW10, £149; **TMS 5100 Talking Board**, GM Microtronics Ltd, Unit 14, Godinton Way industrial Estate, Ashford, Kent, £82.95; **64K DRC Module**, Audio Computers, 87 Bournemouth Park Road, Southend-on-sea, SS5 2JJ, £70 kit, £80 built.



COMMODORE PET 8000

Commodore, 675 Ajax Avenue, Slough, Bucks

STANDARD PACKAGE

Memory Size (RAM)	32K or 96K
Screen Size	25 lines of 80 characters
Expansion Sockets	IEEE 488 standard, parallel output
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	12K
Average Price	£980, £1374

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes various	£454-1604
Monitor	N/A	—
Disc Drives	Yes single or dual	£454-1029
Other Languages	Yes	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

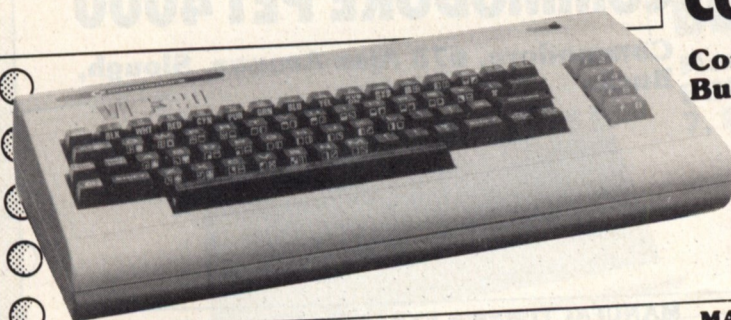
OTHER ADD-ONS:

Universal Interface, Technomatic Ltd, 17 Bunley Road, London NW10, £149; **TMS 5100 Talking Board**, GM Microtronics Ltd, Unit 14, Godinton Way industrial Estate, Godinton Road, Ashford, Kent, £82.95; **64K DRC Module** Audio Computers, 87 Bournemouth Park Road, Southend-on-sea SS5 2JJ, £70 kit, £80 built.

FACTFILE REFERENCE

COMMODORE VIC20

Commodore, 675 Ajax Avenue, Slough, Bucks



STANDARD PACKAGE

Memory Size (RAM)	5K
Screen Size	23 lines of 22 characters
Expansion Sockets	BUS connection, Disc, Printer, Serial output, joystick
Tape Included?	Yes
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	£199.99

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	3K, 8K, 16K expansion options	£30, £45, £75
Printer	Yes	£270
Monitor	No	—
Disc Drives	Yes	£396
Other Languages	No	—
Multi-user	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

TMS 5100 Talking Board, GM Microtonics Ltd, Unit 14, Godinton Way Industrial Estate, Godinton Road, Ashford, Kent, £82.95; **Cassette Conversion Kit**, Swanley Electronics, 32 Goldsel Road, Swanley, Kent BR8 8EZ, £6; **VCR-20, 20K RAM cartridge**, Audio Computers, 87 Bournemouth Park Road, Southend on Sea SS5 2JJ, £39 kit, £45 built; **Expansion Board**, 3K-16K, Arfon Microelectronics Ltd, Gibyn Industrial Estate, Caernafon, Gwynedd, Wales LL55 2BD, £220.

DAI

Data Applications UK Ltd, 16B Dyer Street, Grencester, Gloucestershire, GL7 2PF



STANDARD PACKAGE

Memory Size (RAM)	48K
Screen Size	24 lines of 60 characters
Expansion Sockets	BUS connection, Serial output, joystick socket
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	16K
Average Price	£575

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	No	—
Monitor	No	—
Disc Drives	Yes	TBA
Other Languages	No	—
Multi-user	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	Yes, maths pack	£149

OTHER ADD-ONS:

None Reported



VIDEO GENIE I

**Lowe Electronics, Bentley Bridge,
Chesterfield Road, Matlock,
Derbyshire, DE4 5LE**

STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	16 lines of 64 characters
Expansion Sockets	BUS connector
Tape Included?	Yes
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	12K
Average Price	£279

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	optional 48K in expansion unit	£200
Printer	Yes	£210
Monitor	Yes	£69.99
Disc Drives	Yes, single and dual	£220-375
Other Languages	No	—
Multi-user	Capabilities	No
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Disc drives, single and dual, Cumara Ltd, 35 Walnut Tree Close, Guildford, Surrey GU1 4UN, £199-799; **Olivetti disc drives single and dual**, Kram Electronics, Victoria House, 17 Highcross St, Leicester LE1 4PF, £179-349; **EG3014 Expansion box with 16K/32K RAM**, Swanley Electronics, 32 Goldsel Road, Swanley, Kent BR8 8EZ, £199-213; **48K internal RAM**, General Northern Microcomputers, GNOMIC, 46 Middle Street, Blackhall, Martlepool, Cleveland, £70 + VAT; **32K RAM Card** Audio Computer, 87 Bournemouth Park Road, Southend-on-sea, SS5 2JJ, £40 kit, £46 built.



VIDEO GENIE II

**Lowe Electronics, Bentley Bridge,
Chesterfield Road, Matlock, Derbyshire
DE4 5LE**

STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	16 lines of 32 or 64 characters
Expansion Sockets	BUS connector
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	13K
Average Price	£299

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	optional 48K in expansion unit	£200
Printer	Yes	£210
Monitor	Yes	£69.99
Disc Drives	Yes, single and dual	£220-375
Other Languages	No	—
Multi-user	Capabilities	No
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Disc drives, single and dual, Cumana Ltd, 35, Walnut Tree Close, Guildford, Surrey, Gul 4UN, £199-799; **Olivetti disc drives single and dual**, Kram Electronics, Victoria House, 17 Highcross St, Leicester LE1 4PF, £179-349; **EG3014 Expansion box with 16K/32K RAM**, Swanley Electronics, 32 Goldsel Road, Swanley, Kent BR8 8EZ, £199-213; **48K internal RAM**, General Northern Microcomputers, GNOMIC, 46 Middle Street, Blackhall, Hartlepool, Cleveland, £70 + VAT; **32K RAM Card** Audio Computers, 87 Bournemouth Park Road, Southend-on-sea, SS5 2JJ, £40 kit, £46 built.

FACTFILE REFERENCE



MICROCONTROLLER

Midwich Computer Company, Ltd,
Hewitt House, Northgate Street,
Bury St. Edmunds,
Suffolk IP33 1HQ.

STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	24 lines of 40 characters
Expansion Sockets	Serial output BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K (control BASIC)
Average Price	£375

OTHER ADD-ONS:

None Reported

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes	POA
Monitor	Yes, 9" or 12" screen	£135-149
Disc Drives	No	—
Other Languages	No	—
Multi-user	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	No	—



NASCOM 3

Lucas Logic, NASCOM
Microcomputers Division, Welton
Road, Wedgenuck Industrial Estate,
Warwick, CV34 5PZ.

STANDARD PACKAGE

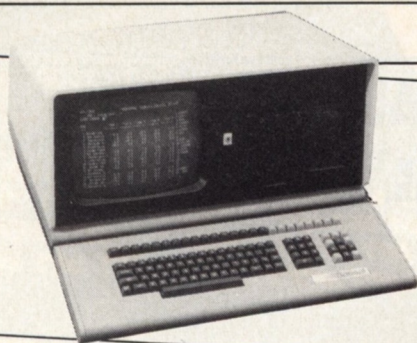
Memory Size (RAM)	0-48K
Screen Size	25 lines of 40 or 80 character
Expansion Sockets	Parallel & serial outputs, BUS connections
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	10K
Average Price	£376-500

OTHER ADD-ONS:

Olivetti disc drives, single and dual, Kram Electronics, Victoria House, 17, Highcross St., Leicester, LE1 4PF, £179-349; **A/D Board**, 10, Research Ltd, 6, Laleham Avenue, Mill Hill, London NW7 3HL, £120 + VAT; **Hobbit - mini-cassette system**, Ikon Computer Products, Kiln Lane, Laugharne, Cownthen, Dyfed, £99 + VAT; **Disc drives, single and dual**, Micro-Spares, 19, Roseburn Terrace, Edinburgh, EH12 5N9, £199-279.

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	up to 48K (max)	£130
Printer	No	—
Monitor	No	—
Disc Drives	Yes, single or dual	£470-700
Other Languages	No	—
Multi-user	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	Yes	£15-50



NEC PC8000

IBR, Unit 57, Sutton Industrial Park,
London Road, Earley, Reading, Bucks.

STANDARD PACKAGE

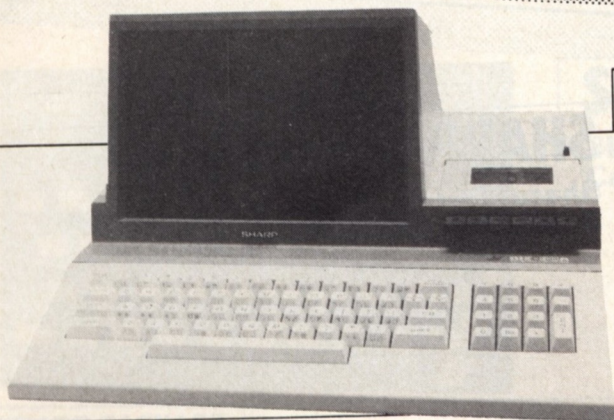
Memory Size (RAM)	32K
Screen Size	25 lines of 80 characters
Expansion Sockets	Parallel output Bus Connector
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	24K
Average Price	£599

MANUFACTURER'S EXPANSIONS

RAM	DETAILS	PRICE
	optional 32K RAM packs (up to 128K)	£109
Printer	Yes	£375-1450
Monitor	Yes	£149-£549
Disc Drives	Yes, dual	£625
Other Languages	Yes	£200-£500
Multi-user Capabilities	Yes	
BASIC extensions (Toolkits)	No	P.O.A.

OTHER ADD-ONS:

None Reported



SHARP MZ-80A

Sharp UK Ltd, Thorn Road, Newton
Heath, Manchester M10 9BE
Tel: 061-205 2333.

STANDARD PACKAGE

Memory Size (RAM)	48K
Screen Size	25 lines of 40 characters
Expansion Sockets	BUS connector
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	12K
Average Price	£549

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes	£450-800
Monitor	N/A	—
Disc Drives	Yes, dual	£600
Other Languages	Yes	£45
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

None Reported

FACTFILE REFERENCE

SHARP MZ-80B

Sharp UK Ltd, Thorn Road, Newton
Heath, Manchester M10 9BE

STANDARD PACKAGE

Memory Size (RAM)	64K
Screen Size	25 lines of 40 or 80 characters
Expansion Sockets	BUS connector
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	16K
Average Price	£990

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	Yes	£120
Printer	Yes	£450-800
Monitor	N/A	—
Disc Drives	Yes, dual	£600
Other Languages	Yes	£45
Multi-user	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Multi-vision and triple-vision, Datron Micro Centre, 2 Abbeydale Road, Sheffield S7 1FD, £35-79

SHARP MZ-80K

Sharp UK Ltd, Thorn Road, Newton
Heath, Manchester M10 9BE

STANDARD PACKAGE

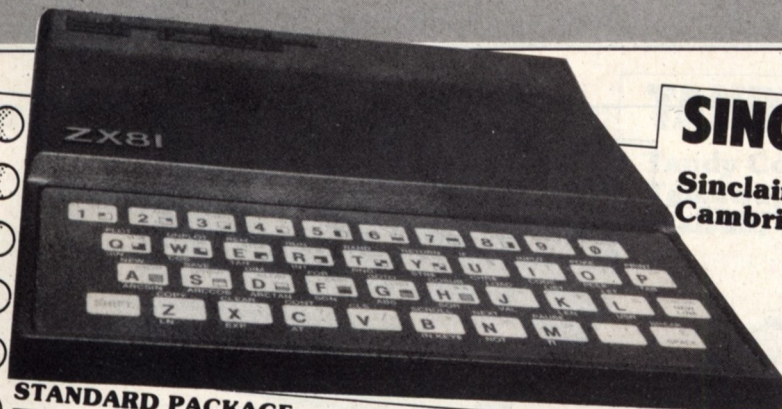
Memory Size (RAM)	48K
Screen Size	25 lines of 40 characters
Expansion Sockets	BUS connector
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	12K
Average Price	£549

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes	£450-800
Monitor	N/A	—
Disc Drives	Yes, dual	£600
Other Languages	Yes	£45 upwards
Multi-user	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

None Reported



SINCLAIR ZX-81

Sinclair Research, 6 Kings Parade,
Cambridge, CB2 1SN

STANDARD PACKAGE

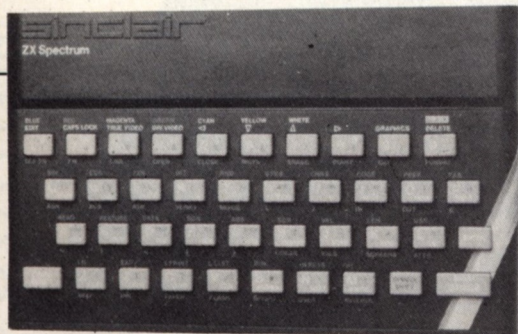
Memory Size (RAM)	1K
Screen Size	24 lines of 32 characters
Expansion Sockets	BUS connections
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	£49.95 kit, £69.95 built

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	16K RAM pack	£29.95
Printer	ZX Printer	£59.95
Monitor	No	—
Disc Drives	No	—
Other Languages	No	—
Multi-user	No	—
Capabilities	No	—
BASIC extensions	No	—
(Toolkits)	No	—

OTHER ADD-ONS:

Memory expansion unit 16K or 64K, Memotech Ltd, 3 Collins St, Oxford OX4 1XL, £39.95-79; Key Bleep Unit, Microtronix, 3 Buxton Avenue, Coulton, Nottingham, N94 3RR, £8.85 kit, £9.95 built; Maximem 1.1, East London Robotics, Finlandia House, 14 Darwell Close, East Ham, London, E84 BT, £93.50; Music Synthesiser + 16 line control port, William Stuart Systems Ltd, Dower House, Billicicay Road, Herongate, Brentwood, Essex CM13 3SD, £19.50; Full-size keyboard, Protos Computer Systems, Frome Computing, 20 Ashtree Road, Frome, Somerset, BA11 2SF, £64.95; ZX99 Automatic tape control, Data-cassette, 44, Shroton Street, London NW1 6UG, £59.95.



SINCLAIR ZX-SPECTRUM

Sinclair Research, 6 Kings Parade,
Cambridge CB2 1SN

STANDARD PACKAGE

Memory Size (RAM)	16-48K
Screen Size	24 lines of 32 characters
Expansion Sockets	BUS connections
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	10K
Average Price	£125 or £175

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	48K RAM for 16K version	£60
Printer	ZX Printer	£59.95
Monitor	No	—
Disc Drives	ZX Microdrive	TBA
Other Languages	No	—
Multi-user	No	TBA
Capabilities	No	—
BASIC extensions	No	—
(Toolkits)	No	—

OTHER ADD-ONS:

None Reported

FACTFILE REFERENCE



SORCERER

EMG, Microcentre, 47 Lower Belgrave Street, London, SW1

STANDARD PACKAGE

Memory Size (RAM)	56K
Screen Size	30 lines of 64 characters
Expansion Sockets	BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	£790

OTHER ADD-ONS:

None Reported

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	£395-1935
Printer	Yes	£160-330
Monitor	Yes	£420-599
Disc Drives	Yes single and dual	£99-420
Other Languages	Yes	—
Multi-user	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	No	—



TANDY TRS 80 I

Tandy Corporation,
12th Floor, Tameway Tower, Walsall,
West Midlands WS1 1LA. Tel:
0922-648181

STANDARD PACKAGE

Memory Size (RAM)	4 or 16K
Screen Size	16 lines of 32 or 64 characters
Expansion Sockets	BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8 or 12K
Average Price	£229 or £339

OTHER ADD-ONS:

Disc drives, single and dual, Cumana Ltd, 35 Walnut Tree Close, Guildford, Surrey GU1 4UN, £199-799; Olivetti disc drives single and dual, Kran Electronics, Victoria House, 17 Highcross St., Leicester LE1 4PF, £179-349; 48K internal RAM, General Northern Microcomputers, (GNOMIC) 46 Middle Street, Blackhall, Marlepool, Cleveland, £70 + VAT; 32K RAM card, Audio Computers, 87 Bournemouth Park Road, Southend on Sea, SS5 2JJ, £40 kit, £46 built.

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	32K extra in expansion unit	£349
Printer	Yes	£239-1200
Monitor	Yes	£100
Disc Drives	Yes	£369
Other Languages	Yes	£100
Multi-user	Yes	—
Capabilities	No	—
BASIC extensions (Toolkits)	Yes	£100



TANDY TRS 80 III

Tandy Corporation, 12th Floor,
Tameway Tower, Bridge Street,
Walsall, West Midlands WS1 1LA

STANDARD PACKAGE

Memory Size (RAM)	4-48K
Screen Size	16 lines of 32 or 64 characters
Expansion Sockets	BUS connection, parallel & serial output
Tape Included?	No
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	16K
Average Price	£599-1799

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	16K modules	£70
Printer	Yes various	£239-1200
Monitor	N/A	—
Disc Drives	Yes	£600
Other Languages	Yes	£100
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	£100

OTHER ADD-ONS:

Disc drives, Cumara Ltd, 35, Walnut Tree Close, Guildford, Surrey GU1 4UN, £199-799; **Olivetti disc drives single and dual**, Kram Electronics, Victoria House, 17, Highcross St, Leicester LE1 4PF, £179-349; **48K internal RAM**, General Northern Microcomputers, (GNOMIC), 46 Middle Street, Blackhall, Hartlepool, Cleveland, £70 + VAT; **32K RAM card**, Audio Computers, 87 Bournemouth Park Road, Southend on Sea, SS5 2JJ, £40 kit, £46 built.



TANDY COLOUR

Tandy Corporation, 12th Floor,
Tameway Tower, Bridge Street,
Walsall, West Midlands, WS1 1LA
Tel: 0922-648181

STANDARD PACKAGE

Memory Size (RAM)	16-32K
Screen Size	16 lines of 32 characters
Expansion Sockets	Serial output, ROM pack, joystick socket
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8-16K
Average Price	£499

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes various	£239-1200
Monitor	No	—
Disc Drives	Yes	£439
Other Languages	No	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Olivetti disc drives single and dual, Kram Electronics, Victoria House, 17 Highcross St., Leicester LE1 4PF, £179-349.



TANGERINE MICRON

Tangerine Computer Systems Ltd,
The Science Park, Milton Road,
Cambridge CB4 4BH

STANDARD PACKAGE

Memory Size (RAM)	8K
Screen Size	16 lines of 32 characters
Expansion Sockets	Parallel & serial output, BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	10K
Average Price	£395

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	48K in system rack	£144
Printer	No	—
Monitor	No	TBA
Disc Drives	Yes	£40
Other Languages	Yes	—
Multi-user	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Sound Board and Graphics Board, Bulldog Video Ltd, 52, Nash Square, Birmingham, B42 2EX, £49-£179; **Toolkit**, Microtanic Software, 235, Friern Road, Dulwich, London, OBD, £22.50.



TEXAS TI 99/4A

Texas Instruments,
European Consumer Division, Manton
Lane, Bedford MK41 7PA

STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	24 lines of 32 characters
Expansion Sockets	ROM pack, Bus connector, joystick, socket
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	14K
Average Price	£299

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	up to 48K (max)	£300
Printer	Yes	£275
Monitor	No	—
Disc Drives	Yes	£300
Other Languages	No	—
Multi-user	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	Yes	£100

OTHER ADD-ONS:

None Reported



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64K-	£65.95

1K ZXCHESS! £2.95

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ADVENTURE 'B' £7.00

ADVENTURE 'C' £8.00

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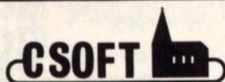
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SOFTWARE REVIEW

This is the place to find out more about the software for your micro. Each month we review a hat-full of tapes and bring you the results.

Each month PC will be presenting pages of reviews of the computer programs currently available. We have engaged a team of reviewers, each of whom is a seasoned user of his/her particular machine — and has the crazy streak that means they enjoy playing computer games!

All types of software will, however, be reviewed in these pages; but with around 85% of all home-computer software being of the playful variety, you will be seeing more games than anything else!

Each program is examined for ease of use, interest level, graphics, etc, and the reviews will be presented in a uniform manner to allow you to compare directly between alternatives.

Our 'Ratings Table' headings are:

Program Quality

Here we're looking to see how well written the program is, and how well it exploits the computer's capabilities. Also, how logical is the structure of the program? Does it require the user to make guesses to use it?

Crashproofing

We all hit the wrong key sometimes, do we not? Go on, admit it. If the program has been well written, all should not be lost. If, for example, the machine is asking you to enter "Yes" or "No", then any other key except Y or N should illicit no response whatsoever. In other words, how tolerant is the program of us humans?

Value For Money

Quite frankly, some software on sale today is vastly overpriced. With the low cost of cassette tapes, why *should* simple games cost up to £12 per tape? We judge this one on an overall basis — how much work have the suppliers put into the program and is the price reasonable?

Presentation On-screen

How good are the graphics used in the program? If the instructions are provided on screen, are they both readable and easy to understand? This section examines the visual aspects of the package — vital for games!

Ease Of Use

If the program is for, say, an 'action' game, then the author's choice of keys is very important. Try playing "Invaders" with the movement keys reversed, and the "Fire" button right next to 'Reset'. There are many, many ways in which life can be made easy for the program user. We want to see them *all* used!

Supplied Instructions

Regardless of whether the instructions come on sheets of paper, or are presented as text on-screen, they should be as clear and as concise as possible. One of our pet hates is when you have to LOAD twice; once just to read screens full of words and again to use the software. Pointless! Far better to supply a few Xerox sheets!

Ratings are done on a "Five stars is excellent, one is hopeless" basis, with the reviewer then scoring the supplied package as a whole on a percentage scale.

We would very much like to hear from you, our readers, as to your comments (printable ones only please) on our methods of reviewing software. Any ideas on how we can improve it?

Title: Cosmic Aliens
Type: Tape
Supplier: Supersoft
Machine: PET
Price: £8

A real demonstration of what is possible with the PET! Very cunning usage of the available graphics produces a different and exciting space game. Cosmic Aliens begins as a "Space Invaders" type game then becomes an "Asteroids" battle and ends up as a sharp shooting session to earn fuel and ammo!

You start by having to clear a screenful of Invaders, which are superbly drawn (for a change), using up your limited supply of fuel in the process. Hitting the "Mother Ship" earns you points — but beware. This Mother Ship can fight back! It drops bombs which move very fast, and go

straight through defences! Hiding will avail you nothing!

After clearing the little bugs away, the screen wipes into a 'meteorite storm' in which — if you're good enough — you can re-charge your tanks by shooting out the correct asteroids and avoiding the rest!

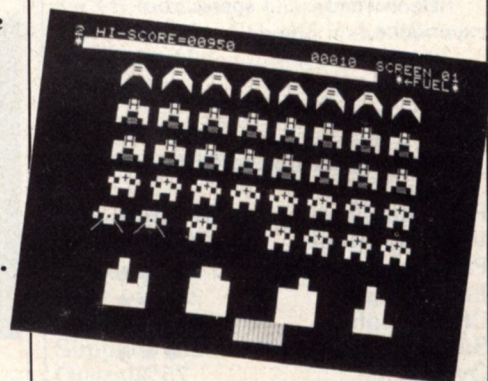
After *that*, assuming you're still alive comes 'Phase Three', in which you have to shoot through a maze type display to hit PART of a moving alien ship. Only part, mind, and it is moving!

More than that I refuse to reveal — life must hold some surprises after all. Suffice to say that "Cosmic Aliens" gets my vote for 'Game of the Month'!

R.H.

Ratings Table

Program Quality	****
Value for Money	****
Presentation On-screen	*****
Ease of Use	****
Crashproofing	****
Supplied Instructions	*
Overall	80%



SOFTWARE REVIEW

Title: Jelly Monsters
Type: Cartridge
Supplier: Commodore Dealers
Machine: VIC-20
Price: £19.95 inc. VAT

At last it's here, after being around for nearly a year in prototype form, Commodore have finally released 'Jelly Monsters' — their cartridge version of the game 'Pacman'. The verdict: very good indeed.

It is a faithful reproduction of the pub game which captured the hearts and wallets of countless thousands across the country. For those of you that have been on other planets for the past year or so I will explain.

The idea behind Jelly Monsters is that you are a large yellow blob with a huge mouth (!) and a voracious appetite, whose one aim in life is to travel round a maze eating the dots that are scattered on the floor. The only thing preventing you from indulging in your passion is the fact that also inhabiting the maze are four pretty nasty 'Jelly Monsters'. They spend their time chasing you round the maze with the unfortunate habit of killing you if they catch you.

All is not lost though, because situated in the four corners of the maze are power pills which, when eaten, allow you to chase and devour the Jelly Monsters. The scoring for this game is fairly simple, 10 points per dot and 200 points for the first Jelly Monster, 400 for the second, etc.

It is refreshing to see a program which makes such good use of the VIC's facilities, the graphics are superb, the colour and sound are well implemented and the action is fast and smooth. My only criticism is that as the Jelly Monsters move around they do flicker slightly. Otherwise — superb graphics.

In conclusion, Jelly Monsters is a highly addictive game (as can be seen from the USA, where everyone above the age of 10 seems to be expert at it) and it will keep you in front of the VIC for hours on end.

Be warned ... I speak from experience.

C.P.

Ratings Table

Program Quality	****
Value for Money	****
Presentation On-screen	****
Ease of Use	****
Crashproofing	***
Supplied Instructions	***
Overall	75%

Title: Super Glooper
Type: Tape
Supplier: Supersoft
Machine: PET
Price: £8

The inevitable PET "Pacman" is here to amaze and amuse you — and drive the family mad with the weird sound effects.

By now the entire Universe must know how these games are played. If you don't then read the review of "Jelly Monsters" in this article and lose 100 points for being anti-social and no fun anymore.

In this version, the monsters are rather boring little squares which move relentlessly toward you once freed from their central reservation by you eating too many dots.

Overall the game is probably as faithful a rendition of the arcade game as is possible on the PET. Unfortunately, this inevitably means that the graphics are limited and by comparison with other machine versions, this one is somewhat dull.

I found the control keys awkward to use and remember and this made high scores difficult to achieve, at least at first. (I will *not* be beaten...)

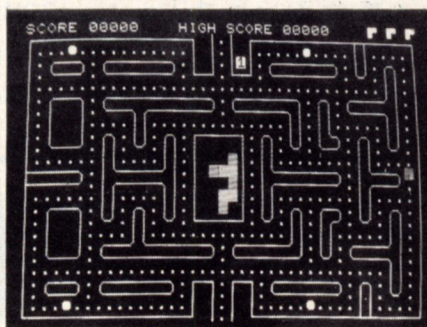
One gripe. It's boring having to go back through the long and tedious instructions when you want to play again. Pointless in a program this well written.

I think this will prove a popular PET program, if only because any serious software collector *has* to have a version of the world's most popular arcade game!

R.H.

Ratings Table

Program Quality	***
Value for Money	***
Presentation On-screen	***
Ease of Use	***
Crashproofing	****
Supplied Instructions	*
Overall	60%



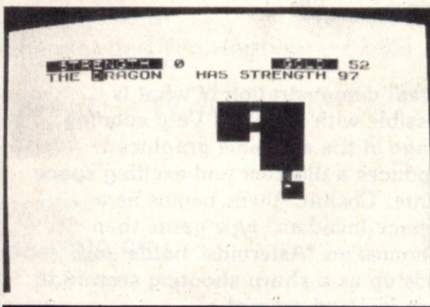
Title: Catacombs
Type: Tape
Supplier: J.K. Greye Software
Machine: Sinclair ZX81
Price: £5.95

"You are alone and lost in the catacombs, how much gold can you find, and how long can you survive?" This game doesn't come up to some of the other adventure games now available. Keys 1-8 move you in the direction indicated on the keys (1-4 diagonally as shown by the graphics character on the keys). The rooms and passages only appear as you move into them and you may find food, gold or monsters. If you beat the monsters or find food, your strength is incremented. You may try to run away from the monsters but they will follow you. Try tunnelling to escape them by shifting keys 5-8. Although acquired skill will help you, the result of a battle with a monster seems a little too random, and the novice gets killed a little too quickly to gain much skill at each attempt. This brings us to the major disturbing factor of this program; once LOAded, the game will automatically RUN and will then take roughly two minutes in FAST mode (with the screen a complete blank) to set up each level. Unfortunately, to the novice it appears that the computer is spending more time setting the stage than the player is playing! We are told that there are an infinite number of levels but also that there is an exit on each level!

P.F.

Ratings Table

Program Quality	**
Value for Money	**
Presentation On-screen	***
Ease of Use	**
Crashproofing	****
Supplied Instructions	***
Overall	53%



Title: UFO
Type: Tape
Supplier: Knights Computers
Machine: Sharp MZ-80K
Price: £8

Just about the most difficult computer game we've come across! This is so

fast — it's maddening. The supplier, Knights, realise the difficulty but refuse to slow down the thing on the grounds that it's more fun this way!

As you can see from the photo, UFO is not a 'Space Invaders' by some other name. A matrix of corridors is produced on the screen at the top of which ten UFOs appear, one by one — accompanied by worrying sound effects.

You control a little man, stuck at the bottom right. Once all ten baddies are present, they come after you — very, very fast. Your only defence is to missile them out before they get to you. Missiles can only be fired in the direction you're moving and you HAVE to keep moving.

It's fast; it's well-nigh impossible to beat; it's never boring — there isn't time to get bored — and it's compulsive. UFO is written in machine code for speed and is loaded from the monitor, rather than BASIC.

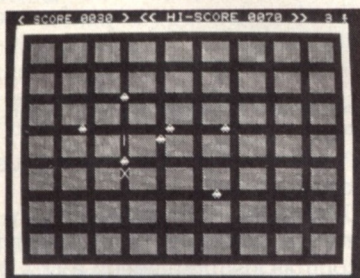
The program is so simple to use and so hard to beat it'll probably become a classic of its kind.

I hate it!

R.H.

Ratings Table

Program Quality	****
Value for Money	****
Presentation On-screen	****
Ease of Use	****
Crashproofing	****
Supplied Instructions	**
Overall	75%



Title: Centipede
Type: Tape
Supplier: OD'Tronics
Machine: Sinclair ZX81
Price: £4.95

Yet another twist to shooting down the attacking aliens. These particular creatures take the form of a segmented attack craft that moves from side to side on the screen, descending each time it hits either the frame at the sides or one of the randomly placed obstructions. You have a number of 'bases' (1-5... your choice) and you lose a base if you are hit by one of the alien's bombs or if they descend to 'ground level'. You may fire your laser

cannon at the attackers, and if you hit a segment it will be destroyed, but if your hit is in the middle then the alien will split into two and both halves will continue independently. As the attackers are destroyed — or destroy your bases, they will be replaced. As the game proceeds the attackers will become more numerous and will also start to drop bombs on you! You may choose the breakdown — 20 for a novice! Instructions appear on-screen at the start of the game. The top 10 scores may be recorded by name, and remain in memory until you either switch off or alter the speed or number of bases. An innovative game with enough preset variation to appeal to all. Fast and entertaining.

P.F.

Ratings Table

Program Quality	****
Value for Money	****
Presentation On-screen	****
Ease of Use	****
Crashproofing	****
Supplied Instructions	****
Overall	70%

Title: ZX Galaxians
Type: Tape
Supplier: Artic Computing
Machine: Sinclair ZX81
Price: £6.50

A good version for the Sinclair of the well known arcade game. You have three spacecraft equipped with the now mandatory laser guns! In front of you are the formations of the hostile Galaxians; shoot down one fleet and another will take its place. Meanwhile some of the enemy craft will peel off from their close formation and swoop down upon you dropping bombs as they go.

You have control of your position — left and right movement — and an inexhaustible supply of laser bolts! The number of attack craft aiming for you increases but the overall speed of the game is well balanced. Slow enough for the novice to get the feel of the game, but fast enough for the experienced tactician to travel some way and score a satisfying number of hits before he gets beaten to death!

P.F.

Ratings Table

Program Quality	****
Value for Money	****
Presentation On-screen	****
Ease of Use	****
Crashproofing	**
Supplied Instructions	****
Overall	63%

Title: The Alien
Type: Tape
Supplier: Audiogenic
Machine: VIC-20
Price: £9.95

It is always a dangerous move giving a piece of software a grandiose title, but luckily The Alien, from Audiogenic, doesn't come off too badly. It is based, as with a lot of other programs, on a maze, except that in this variation your task is not to escape, but to survive. The program is written in machine-code and requires an extra 3K of memory over and above the standard machine.

When the game starts you are placed in control of a man stranded in the middle of the maze. For company he has 5 or 6 aliens who behave in a very unfriendly manner and try to eat him. You move about the maze avoiding the aliens, by using either the keyboard or a joystick. When you are safe from immediate danger you can set about inflicting your revenge on the aliens by digging pits for them to blunder into. Once you have snared an unsuspecting alien you must then rush to the side of the pit and fill it in, but be warned, if you do not reach the pit in time, then the alien will escape, usually straight towards you.

This is not your only problem, because if one of his companions comes by he will rescue him and both will set off with a justifiable blood-lust in their eyes.

As the game progresses and you manage to clear all of the aliens you are placed in another maze with even more homicidal extraterrestrials. The game finally ends when you have lost your three lives.

This is a well written game that is a lot of fun to play but the thing which makes it an above average buy is the inclusion of a few humorous extras, such as the sight of a very rotund, grinning alien with your feet sticking out of its mouth and the transformation of yourself into an angel which wafts serenely to the top of the screen on your demise. Once again good use of the VIC's definable characters and its colour and sound should make this a welcome addition to anyone's collection.

C.P.

Ratings Table

Program Quality	****
Value for Money	****
Presentation On-screen	****
Ease of Use	****
Crashproofing	****
Supplied Instructions	****
Overall	80%

New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumerics and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.

Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.

Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.

Description – Fives games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.

Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.

Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Galactic Invasion. Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.

Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.

Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Star Trail (plus blank tape on side 2).

Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – What are Biorhythms? Your Biohythms.

Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Programs – Backgammon. Dice.

Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Chess. Chess Clock.

Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.



Cassette G12:

Fantasy Games (Psion)

Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.

Price – £4.75.

Programs – Perilous Swamp. Sorcerer's Island.

Description – Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13:

Space Raiders and Bomber (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £3.95.

Programs – Space Raiders. Bomber.

Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Program – Flight Simulation (plus blank tape on side 2).

Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Novelists. Authors.

Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Poets. Playwrights. Modern Authors.

Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series – Geography 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Towns in England and

Wales. Countries and Capitals of Europe.

Description – The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series – History 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Events in British History.

British Monarchs.

Description – From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series – Mathematics 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Addition/Subtraction.

Multiplication/Division.

Description – Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series – Music 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Composers. Musicians.

Description – Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series – Inventions 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Inventions before 1850.

Inventions since 1850.

Description – Who invented television?

What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series – Spelling 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Series A1-A15. Series B1-B15.

Description – Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £9.95.

Program – Collector's Pack, plus blank tape or side 2 for program/data storage.

Description – This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £9.95.

Program – Club Record Controller plus blank tape on side 2 for program/data storage.

Description – Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information – eg type of membership.

Cassette B3: VU-CALC (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £7.95.

Program – VU-CALC.

Description – Turns your ZX81 into an immensely powerful analysis chart.

VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £7.95.

Programs – VU-FILE. Examples.

Description – A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

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	G13: Space Raiders & Bomber	42	£3.95	
	G14: Flight Simulation	43	£5.95	
	E1: English Literature 1	44	£6.95	

Qty	Cassette	Code	Item price	Total
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	E3: Geography 1	46	£6.95	
	E4: History 1	47	£6.95	
	E5: Mathematics 1	48	£6.95	
	E6: Music 1	49	£6.95	
	E7: Inventions 1	50	£6.95	
	E8: Spelling 1	51	£6.95	
	B1: Collector's Pack	52	£9.95	
	B2: Club Record Controller	53	£9.95	
	B3: VU-CALC	54	£7.95	
	B4: VU-FILE	55	£7.95	
	ZX 16K RAM pack	18	£29.95	
	ZX Printer	27	£59.95	
	Post & packing – only if ordering hardware		£2.95	

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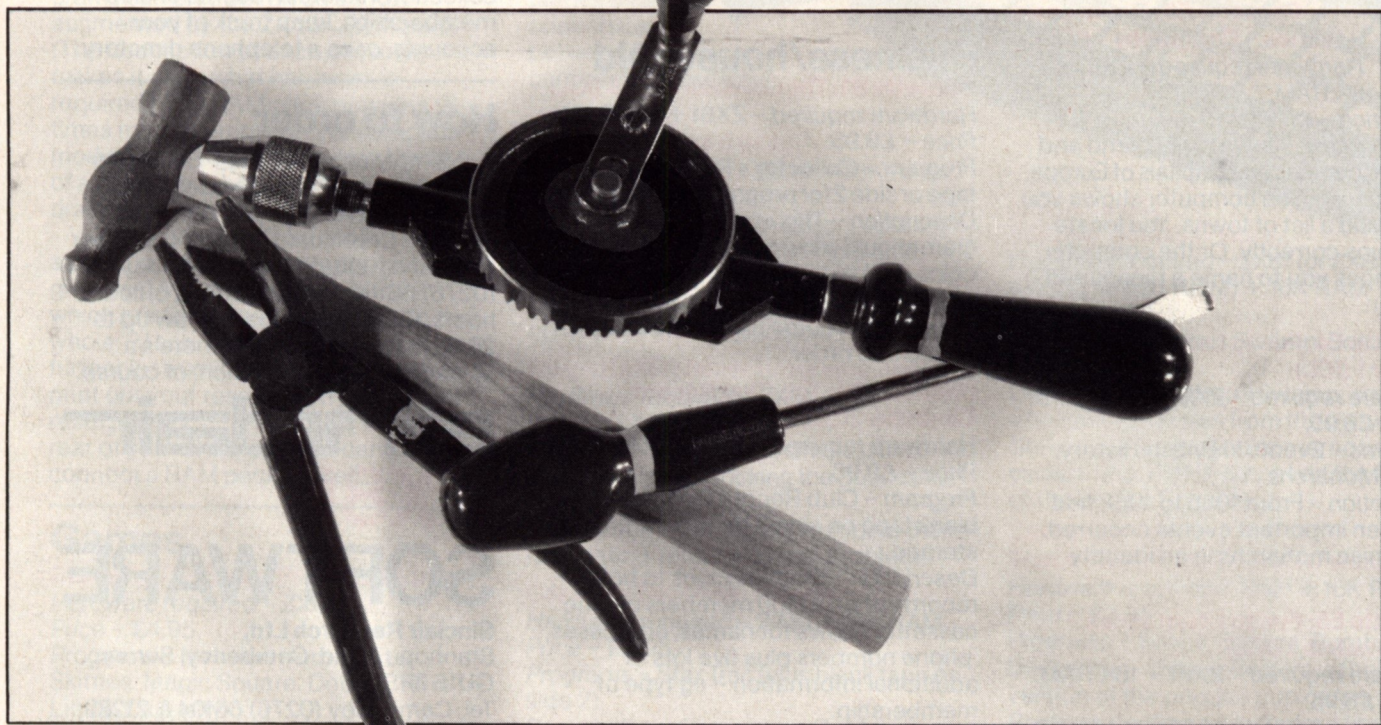
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When running, the Programmer's Aid displays a "Menu" telling you what is available, but the following describes in detail the action of each option:

Edit Command (E)

The program chooses FAST mode, which is more convenient to use than SLOW while editing. The pro-

gram LISTs beginning with the current line. This often saves having to search through the list to find your current problem.

Lines 1000 to 6999 are free for your own program. When you have finished entering, or you wish to SAVE what has been created to date, enter RETURN (on the Y key) as a direct instruction, when the Programmer's Aid will choose SLOW mode and return to the Menu.

"Memory Left" Routine (M)

This displays the number of bytes free for programs, variables, and machine stack. It is written in machine code. An assembly language listing is shown as Diagram 1 — consult your Sinclair manuals if you are unsure how to enter this program into your ZX81.

Diagram 1
Memory Left Routine

HEX		
21	00 00	LD HL,0
39		ADD HL,SP
ED	4B 1C 40	LD BC,(STKEND)
A7		AND A
ED	42	SBC HL,BC
44		LD B,H
4D		LD C,L
C9		RET

Renumber Your Programs (R)

Choosing R will instantly renumber the appropriate sections of your program, and then LIST from the current line. Unlike other renumbering routines, however, a line number is left unchanged unless it is closer to the previous line number than 5 lines.

Correctly used, this enables you to insert new lines where required without altering GOSUB and GOTO numbers!

All that is required, is that you begin these sections of the program with line numbers that are sufficiently far away from the previous ones to allow for additions. Usually multiples of 50 or 100 are convenient.

If you wish to alter the interval between lines, then POKE 16563 with the new number. This section is written in machine code too, and an assembly listing is given in Diagram 2. Again be careful with entry! Take your time and check everything.

Diagram 2
Renumber Routine

HEX			
21	7D 40	LD HL,407D	Address of first line no.
11	00 00	LD DE,00	
:L1	7E	LD A,(HL)	
E6	C0	AND C0	Test for end of program
C0		RET NZ	
E5		PUSH HL	
46		LD B,(HL)	
23		INC HL	Load BC with line no.
4E		LD C,(HL)	
23		INC HL	
EB		EX DE, HL	
E5		PUSH HL	
ED	42	SBC HL,BC	Test for highest line no.
E1		POP HL	
38	12	JR C,L3	
C1		POP BC	
7C		LD A,H	
02		LD (BC),A	Old no. higher — POKE
03		INC BC	
7D		LD A,L	
02		LD (BC),A	
01	05 00	LD BC,05	Add 5 to new line no.
:L2	EB	EX DE,HL	
09		ADD HL,BV	
:L2	EB	EX DE,HL	
23		INC HL	Find no. bytes to next line number
46		LD B,(HL)	
23		INC HL	
09		ADD HL,BC	Calc. address of next line no.
18	DE	JR L1	
:L3	60	LD H,B	
69		LD L,C	New no. higher — no action
C1		POP BC	
18	EF	JR L2	

SAVing Problems (S)

Under this option, the program is SAVED on tape under the first four characters of its title. When reloaded, it starts automatically.

Print Title (T)

Enables you to alter the title as printed out at the beginning of each screen.

What Variables? (U)

All variables so far created are printed out, together with their length. The order in which they are listed is that in which they are held by the computer. The Dimensioned variables are separately identified, as are Strings and 'For' Loops. This will enable you to avoid using the same letter twice in the same program.

Menu For a Meal Of Programs

The line numbers chosen for use by the menu have been carefully picked to allow you to use this feature in your own programs. For example, to insert an option beginning with A (eg Adventure) line 7040 should read 7040 PRINT "A-ADVENTURE". For an item starting with B use line 7050, C 7060 etc.

When A is selected from the menu, the computer assigns control to line 7400; when B is selected, control is transferred to line 7500, C 7600 and so on. There are, therefore, 100 line numbers for you to use for each letter (more if the following letter is unused). If this is insufficient, then control should be transferred to the main program between lines 1000 and 7000.

Keep a chart of these numbers handy for ease of reference.

When any option is chosen, FAST mode is brought into operation. If SLOW is required, then make this the first line of your section of program.

All the variables used in this Programmer's Aid, with the exception of T\$, ER and OP may be used in your own program as temporary data stores.

Other Useful Subroutines

Three other useful subroutines are included.

GOSUB 100 will print the title, T\$.

GOSUB 200 produces an indefinite pause, very useful when in FAST mode. When any key is depressed, the screen is cleared, FAST mode chosen, and control returned to the main program. Variable V will contain the code of the key selected.

If key C is chosen, a copy of the screen is sent to the printer, if attached.

As a slight variation, when GOSUB 190 is used instead, "PRESS ANY KEY FOR MORE" is also printed. This can be useful when the screen is full.

If GOTO is used instead of GOSUB, then, on pressing any key, control is returned to the menu. This will prevent program crashes.

The subroutine at line 900 prints variable L right-aligned provided it is no longer than five characters. This can be useful when you produce lists. To increase the length acceptable, add spaces to I\$ in line 900.

PROGRAMMER'S TOOLKIT

Entering The Program

The listing is in two sections. The preliminary part sets up the machine code routines. All lines after line 20 should be deleted after running the program. For safety, it should be **SAVED** at this stage.

Diagram 3

Preliminary Program

```
10 REM [14 Characters ]
20 REM [45 Characters ]
30 FOR I = 16514 TO 16578
40 PRINT I - 16513
50 INPUT J
60 PRINT J
70 POKE I,J
80 IF PEEK 16442 < 4 THEN CLS
90 NEXT I
```

RUN the program, then enter the following numbers in sequence:-
33 0 0 57 237 75 28 64 167 237 66 68 77 201 118 0 20 47 0 234 33 125
64 17 0 0 126 230 192 192 229 70 35 78 35 235 229 237 66 225 56 18
193 124 2 3 125 2 1 5 0 9 235 78 35 70 35 9 24 222 96 105 193 24 239

Now delete lines 30 to 90 inclusive.

In the main program, please note the following points:-

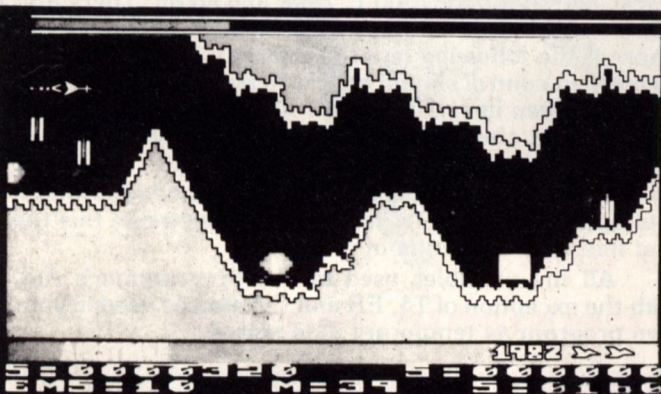
line 190 includes graphics shift H

lines 800 and 850 have 3 spaces then 5 times graphic shift 7

line 810 has three spaces

line 900 is I\$ = five spaces.

After entering the main program, RUN, then enter GOTO OP. The menu should now be displayed. **SAVE** the program, and it is ready for use.



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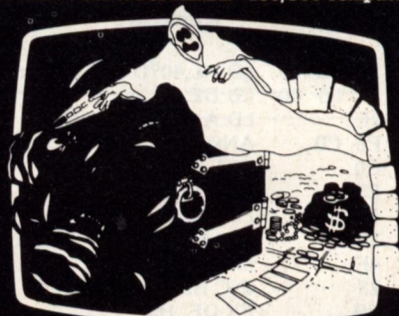
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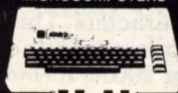
A complete game encompasses 30 rooms and 20 prizes, and prize capture is not always an easy

task; a different technique or twist is involved in obtaining each one. Some require physical dexterity to reach while others can be acquired only through an intellectual problem solving path. Even some rooms are initially hidden from the player and must first be found before their prizes can be captured. Action Quest provides challenges both for fast action players as well as for those motivated by intrigue.

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Diagram 4

```

PROGRAMMER/S AID
MAIN PROGRAM
  60 LET OP=7360
  70 LET T$="PROGRAMMER/S AID"
  80 LET ER=7850
  90 GOTO 1000
100 CLS
110 PRINT T$
120 PRINT
130 RETURN
190 PRINT "PRESS ANY KEY FOR
    "
200 SLOW
205 IF INKEY$<>"" THEN GOTO 205
210 LET V=CODE INKEY$
220 IF V>40 THEN GOTO 250
230 COPY
240 GOTO 210
250 IF V=0 THEN GOTO 210
260 FAST
270 CLS
280 RETURN
290 LET K=0
300 LET X=PEEK 16400+256*PEEK 1
6401
310 LET V=PEEK X
320 IF V=128 THEN GOTO 800
330 LET L=PEEK (X+1)+256*PEEK (
X+2)+3
340 IF V>224 THEN GOTO 410
350 IF V>192 THEN GOTO 440
360 IF V>160 THEN GOTO 470
370 IF V>128 THEN GOTO 570
380 IF V>96 THEN GOTO 600
390 PRINT CHR$ (V-32); "$";
400 GOTO 620
410 PRINT CHR$ (V-192); " (FOR LO
OP) "
420 LET L=16
430 GOTO 620
440 PRINT CHR$ (V-160); "$";
450 GOSUB 700
460 GOTO 620
470 PRINT CHR$ (V-128);
480 LET Y=X
490 LET Y=Y+1
500 LET V=PEEK Y
510 IF V>128 THEN GOTO 540
520 PRINT CHR$ V;
530 GOTO 490
540 PRINT CHR$ (V-128);
550 LET L=Y-X+6
560 GOTO 620
570 PRINT CHR$ (V-96);
580 GOSUB 700
590 GOTO 620
600 PRINT CHR$ (V-64);
610 LET L=6
620 PRINT " = ";
630 GOSUB 900
640 PRINT
650 IF PEEK 16442<6 THEN GOSUB
190
660 LET X=X+L
670 LET K=K+L
680 GOTO 310
700 PRINT "(",
710 LET J=PEEK (X+3)
720 FOR I=1 TO J
730 LET Y=X+2+I*2
740 PRINT PEEK Y+256*PEEK (Y+1)

750 IF I<J THEN PRINT ", ";
760 NEXT I
770 PRINT ")",
780 RETURN
800 PRINT " "
810 PRINT " "
820 LET L=K
830 GOSUB 900
840 PRINT " BYTES"
850 PRINT
890 GOTO 200
900 LET I$=" "
910 LET I$(6-LEN STR$ L TO )=ST
R$ L
920 PRINT I$;
990 RETURN

```

```

7000 STOP
7010 PRINT TAB 12; "EDITING"
7020 PRINT
7080 PRINT "E-EDIT"
7160 PRINT "M-MEMORY LEFT"
7210 PRINT "R-RENUMBER"
7220 PRINT "S-SAVE"
7230 PRINT "T-TITLE"
7250 PRINT "V-VARIABLES"
7300 INPUT I$
7310 LET X=CODE I$-37
7320 IF X<1 OR X>26 THEN GOTO 73
00
7330 FAST
7340 GOSUB 100
7350 GOSUB 7300+X*100
7360 CLS
7370 SLOW
7380 GOSUB 100
7390 GOTO 7010
7800 LIST PEEK 16394+256*PEEK 16
395
7830 STOP
7850 LET L=PEEK 16443
7860 FAST
7865 LET X=7885
7870 LET K=PEEK 16427+256*PEEK 1
6428
7875 LIST K
7880 STOP
7885 IF L THEN SLOW
7890 GOTO K
8600 PRINT "MEMORY LEFT = ";USR
16514; " BYTES"
8610 GOTO 200
9100 RAND USR 16534
9110 GOTO 7800
9200 LET I$=T$(1 TO 4)
9210 SAVE I$
9220 GOTO 7370
9300 PRINT "TITLE?"
9310 INPUT T$
9320 RETURN
9500 GOTO 290
9999 RETURN

```

Running Your Own Programs

You are now in a position to enter your own program and RUN it. During this stage, the program may stop, display an error code. If this happens, then enter GOTO ER.FAST mode will be selected, and a listing produced beginning with the line containing the error. When you have corrected it, enter GOTO X and the run will continue.

If, instead of correcting the error, you wish to return to the list of options, enter GOTO OP, and the menu will be displayed. RETURN will also work.

Diagram 5

SAMPLE RUN

```

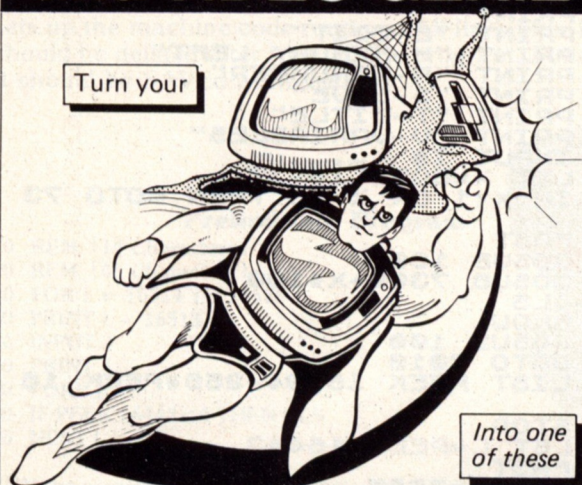
PROGRAMMER/S AID
MEMORY LEFT = 13311 BYTES
PROGRAMMER/S AID

OP                      =          7
T$                      =         10
ER                      =          7
X                       =          0
V                       =          0
Y                       =          0
Y                       =          0
TEMPO                   =         10
D(5,17,2)               =        850
G$(5,3)                 =         20
I                       =          0
I(FOR LOOP)             =         10
I$                      =          0

938 BYTES

```


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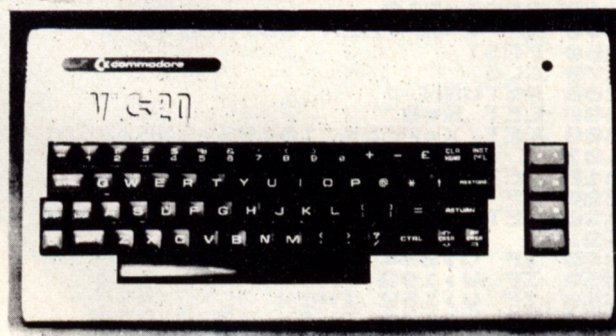
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TECHNICAL ENQUIRIES

MICRO-ANSWERS is Personal Computing's Technical Enquiries Service. Each month we will endeavor to answer your questions on the subject of micro-computing. We would love to hear of your problems (honest!) as it is certain that if you are having trouble then other users of your machine will also be suffering.

So here's your chance to lighten your burden by sharing your troubles with Personal Computing's panel of experts.

Address your letters to:
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 Personal Computing
 ASP Ltd
 145 Charing Cross Road
 London WC2H 0EE

If you wish a personal reply, please enclose a stamped addressed envelope and the reply coupon from this page. This is to enable us to give priority to regular readers of PC.

We start this month with a collection of correspondence from the files of our technical consultants, which deal with the VIC-20, ZX-81 and how to get together with other enthusiasts.

Remember that if you find any of the terminology in Personal Computing difficult, you can look up our explanations in Micro-Terms at the back of the issue. This feature will appear each month and cover the issue it appears in.

Dear PC,
 I have a VIC-20, which is unexpanded, and which I use mainly for writing my own games programs.

I have seen ads in the computer magazines for toolkits and things, but all I want is key repeat! It gets boring having to move the cursor around one key-push at a time.

Is there a program which will give me a key repeat, without having to buy one of these expensive add-on toolkits?

A. Walters
 Bath

Yes! The VIC-20 already has the facility built in, but somehow people don't get told it very often!

**If you type in
 POKE 650, 255
 you will find that all your keys
 now possess a repeat function**

**and will continue to do so
 until you type in
 POKE 650, 67**

**On the other hand if you
 just want to have the repeat
 function on the cursor control
 keys and the space bar, type
 in**

**POKE 650, 0
 It can be switched off with
 the same command as before,
 ie**

**POKE 650, 67
 All you have done here is
 to place a particular number
 into a particular spot in the
 VIC's memory. In this case, it
 is the location which controls
 the facility for key repeat.**

Dear PC,
 I have owned a ZX81 for over six months now and have not long ago bought a 16K memory pack and the Sinclair printer. I saw the new

Sinclair ZX Spectrum at the Microfair recently and ordered one!

What I want to know is can I use my add-on memory and printer with the new Sinclair? I cannot find anything in the Sinclair literature which would tell me. I have ordered a 16K Spectrum and if I can fit the pack for the ZX81 I can get 32K of memory.

If I have to modify my Spectrum to fit the RAM pack, please supply details of the modifications required.
 C. Martin
 London

Some good news and some band news.

Yes, you can use your newly acquired printer with the Spectrum. The two are highly compatible and no problems should be encountered. That's the good news.

PRIORITY REPLY

August 1982 Issue

Personal Computing Reader Enquiry Service

Name

Address

.....



Now the bad... no way will your ZX81 RAM add-on fit your Spectrum! The idea of modifying the brand-new machine is also a non-starter I'm afraid. Better by far to leave it where it belongs and get the proper Spectrum expansion if you begin to feel cramped by the 16K of memory on offer.

A lot of letters have been received by all of our correspondents over the last year, asking for addresses of computer clubs in and around London. So for those who sought and have not yet found:-

North London Hobby Computing Club
Polytechnic of North London
Holloway Road
London N7 8DB
01-607 2789

West London Personal Computer Club
81 Rydal Crescent
Perivale
Middx. UB6 8DZ
01-997 8986

South East London Computer Club
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London SE13 7PG
01-853 5829

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Ducane Road
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Bushey Heath
Watford
Herts WD2 3

Richmond Computer Club
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St. Margarets
Twickenham
Middx.
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A reminder that all clubs should be sending us articles for 'Clubhouse' by now! Lose out on free publicity if you really want to, we can't stop you ...



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You've read the program (Computing Today — April '82)... Now buy the tape. PET and TRS-80, BBC and Sharp tapes are available at £9.95 per tape plus 50p postage and packing. 16K minimum... Commodore PET (New ROMs), TRS-80 Model 1, Level 2, BBC Model B and Sharp MZ-80K.

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Computing Today Software

82/6

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COMPUTER USERS CLUB

In this the first of our regular club features, Tony Latham introduces the Computers Users Club and presents some hints for BBC and Genie owners.

What a good idea it is to have a magazine of this nature where Users Groups and Clubs are given the opportunity to express their views and outline their intentions. Our Computer Users Club was formed mainly to serve the interests of the BBC Micro users and since the predominant quest is computer literacy this has become one of the main objectives of the monthly journal received by members. The programs are arranged to show as many different techniques as are possible, so that when the software is entered into the machine the user quickly and efficiently becomes familiar with routines.

In most cases the programs are capable of being easily translated to other makes of computer and we have many members who do not use the BBC machine. Where any ambiguity arises suggestions and very often alternative routines are offered. Recent program issues for BBC users are "Intelligent Typewriter", capable of being run on 16K machines with cassette recorder. This of course can be expanded enormously for the "B" model with discs, but the idea was that people, even without printers, could save pages of text notes on a filing system basis.

The second program "Hangman" is an animated version of the old classic. He blinks, taps his feet and finger impatiently whilst whistling "Why are We Waiting" during delays. If a wrong letter is entered — instant sadness; the right letter bringing immediate happiness. The game ends with the appropriate music written in 3-part harmony. The Hangman program can be looked upon as high resolution graphics, but has in fact been constructed in the worst graphic mode the BBC

machine offers, outside the Teletext mode.

Both these programs are available to members either as free software listing or tape copies £4.50. Non-members will have to pay £5 per tape.

Worth The Wait?

Many users are only just now receiving their machines, together with a provisional user manual which lacks a certain amount of information and does not give any guidelines to programming. The long delay between ordering and receiving the BBC Micro has been discussed with the powers that be. They were not optimistic of immediately solving the problem but in our opinion the long wait will prove worthwhile once the machine finally arrives.

The Club has assisted many people by telephone and letter to correct faults where these have occurred due to transit, and to guide them regarding programming approach. What a good idea it would be if the "Welcome" tape supplied could be arranged to list the programs given on to printer or screen. It must come as a shock to people completely unused to micros, particularly in view of the massive publicity stating how wonderful these devices are, when the new owner, having finished the Welcome tape, thinks 'What's next?' and it begins to dawn on him that the machine will not dance upon his verbal command!

One of the original ambitions was for the Club to become a nucleus for the exchange of ideas and co-ordinate the efforts of individuals. This is indeed becoming a reality. Membership of the Club ranges from the Outer Hebrides to

France and Germany so we cannot claim to be "national" any more we can claim to be "international" since we have no members at this time outside the EEC. The Club issues a journal every month and supplies a professional binder for the pages. This builds up over the years into a reference manual of program routines and hardware tips. As an example of our work, I present below some extracts from our April 82 newsletter. This deals with the BBC and Video Genie characters and has something to say about the envelope command on the BBC micro. Membership costs 25p per week, payable as a 6-monthly or yearly amount (£12). The journal contains pages of equipment and consumable items plus software tapes, all at discount prices. Our own software generated within the club, regardless of complexity, is offered to members at a fixed price — £4.50. £1.50 of this price is given to the originator of the programme as a token royalty which shows our appreciation of his efforts, and helps to inspire the generation of new material for the club library.

BBC & Video Genie Graphic Characters

The letters appearing on your screen are seen by the computer as numbers arranged as an 8 by 8 matrix. These numbers are decoded by the hardware to appear as dots, in the right combination and on the right line of the VDU.

VDU 23 on the BBC machine is used to design your own characters, or if you like, pieces of a large character. To do this, VDU 23 is followed by character number. Although any of the ASCII character codes can be used it is

best to employ numbers 244 to 255, since these leave your keyboard keys delivering the characters engraved on the key tops. So we have VDU 23, 244, we now add eight other values, these being the totals of the 'powers' for each of the eight rows, eg. Row 1 = $128 + 64 + 32 + 4 + 2 + 1 = 231$

Note that the shaded blocks are not used.

The design shown in Fig. 1 would be made by VDU 23, 244, 231, 219, 189, 189, 12, 9, 189, 189,

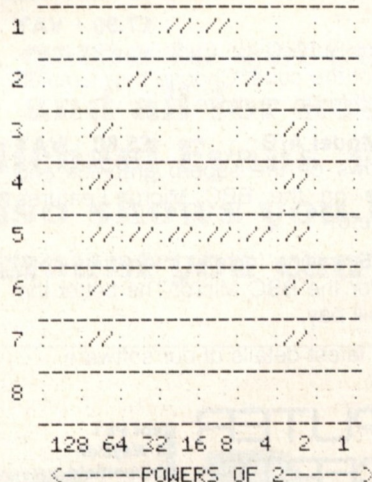


Figure 1.

255. The design can then be printed by PRINT CHR\$(144) or drawn in a row within a for/next loop.

From this you can see that you are able to design as many space invaders as you like. You can (add) blocks together by $A\$ = \text{CHR}\$(144) + \text{CHR}\$(145)$ etc. This form of addition being known by the posh word 'concatenation'.

To enable you to add up the rows, the simple program given below may be of help.

```
10 T = 0 : REM TOTAL
20 PRINT TAB(1,5);"/"
   ENTER NUMBER "X"
30 T = T+X : REM TOTAL=
   PREVIOUS TOTAL
   PLUS NEW NUMBER
40 IF X = 0 THEN 50 ELSE 20
   REM ENTER 0 TO START
   NEXT ROW
50 PRINT "TOTAL = ";T
60 GOTO 10
```

We will leave it to one of you to write a program to draw a matrix, allow the user to colour squares, print the totals, then show the finished block!

Video Genie owners will have to improvise a little. Your graphics blocks can be handled the same way, except in a 2 by 6 matrix and

that 128 will need to be added to the total.

The symbol shown in Fig. 2 is 128 (blank all blocks) + 2 + 4 + 32 (ON) = 166.

```
-----
: / 1 / 2 :
-----
: 4 : / 8 / :
-----
: / 16 : 32 :
-----
```

Figure 2.

The numbers that call the characters are known as ASCII codes where ASCII = American Standard Code for Information Interchange. This is the number that VAL(X\$) would print. If 'A' = X\$ then VAL(X\$) or VAL('A') will print 65.

On BBC machines the 'white' blocks will be in the current foreground colour and the shaded portion will be in the current background colour.

For further details of membership write to:—

Tony Latham,
Computer Users Club,
72 Sidmouth Road,
Welling, Kent.
Telephone: 01-304-3910

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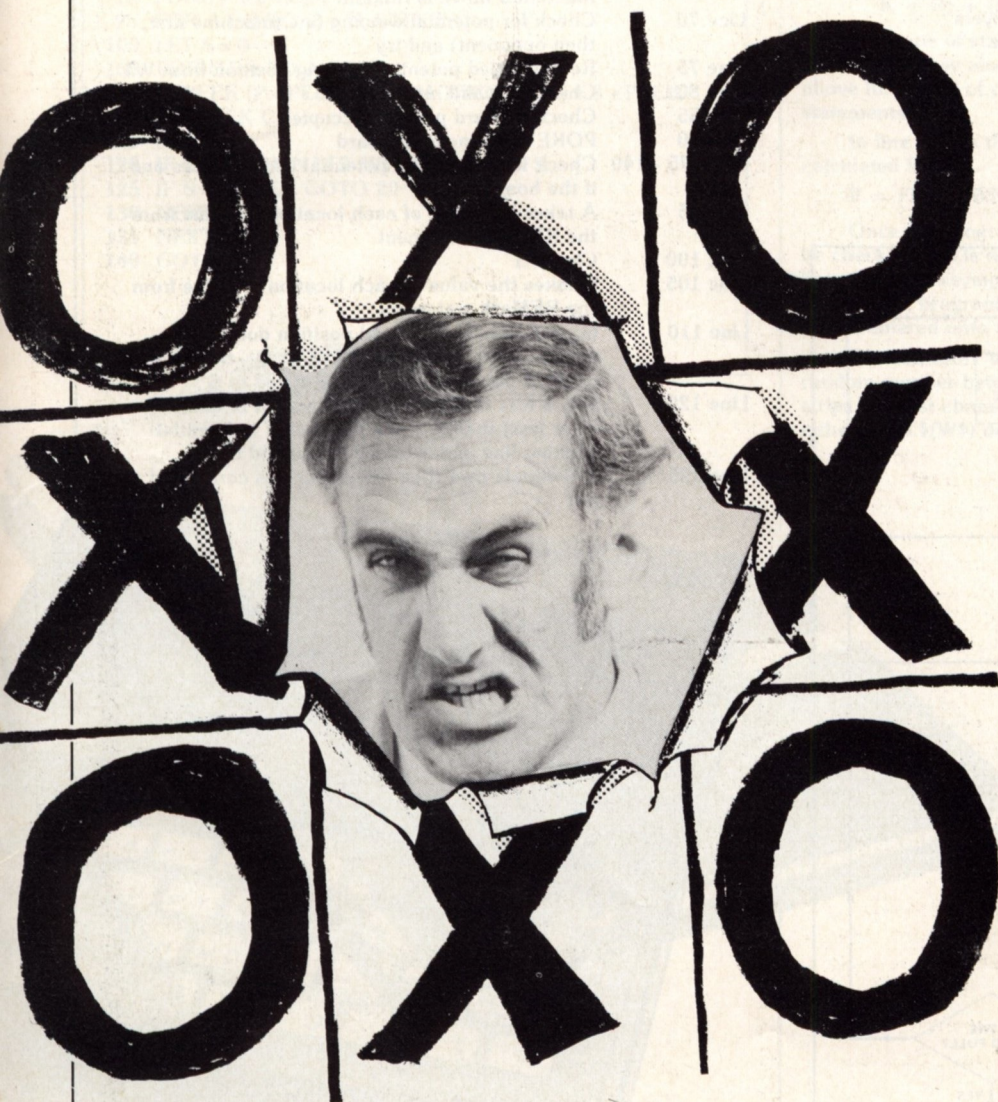
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SOFTWARE

OXON

**A game to get you cross
— and all for nought!**

**Michael Evans' version of the game
also shows you how to increase the
amount you can store in your ZX81.**



The following program for the ZX81 is a new version of OXON, more commonly known as noughts and crosses, with the program emphasis on saving memory space! The program manages to hold a great deal of data in the ZX81's memory, due to the method used to store it within the program.

The data in the program holds the screen (not board) position of lines and the machine's playing strategy when it has the opening move. Note that you can only win when you have the opening. The machine never loses if it moves first... or does it?

The first 24 items of data are in blocks of three representing the eight lines, three horizontal and vertical, and two diagonals. The values of each item of data represent the screen position of the board. Each board position on the screen is separated by a space or a new line, thus the board position in the screen memory is at locations 2, 4, 6 etc. Using the screen in this way, to record the moves already made, uses approximately 50 bytes less than holding the board positions in an array.

Game Strategy

The last 16 items of data represent the machine's game strategy if it has the opening move. The machine always opens with an X in the top left corner, thus leaving you with one of eight moves.

The first eight items hold the machine's response to the opponent's first move.

Usually the machine's second move will result in the opponent having to block a winning line. If the opponent does not block the winning line the machine will then complete the winning line on its third move. If the opponent blocks the winning line the machine reverts to its game strategy for its third move, this is contained in the last eight items of data, and this move is also dependent on the

opponent's first move. Of the eight replies that the opponent can make only one does not definitely result in a win for the machine; none result in the opponent winning!

How To Move

When the program is run the machine asks for an input. The opponent has the first move. After entering a move it is checked then an O is entered onto the screen in the required position. The machine then has its move entering its X onto the screen and then prompts for another move from the

opponent. At the end of the game the machine sets up a new board, this time the loser goes first, or in the case of a drawn game the first move is alternated.

By removing lines 54 to 75 and inserting the following lines:

```
51 PRINT CHR$(M); " TO
MOVE"
61 IF M = 61 THEN INPUT C
```

two opponents may play each other using the machine as a scratch pad.

One final suggestion is that the LET statement in line 61 is

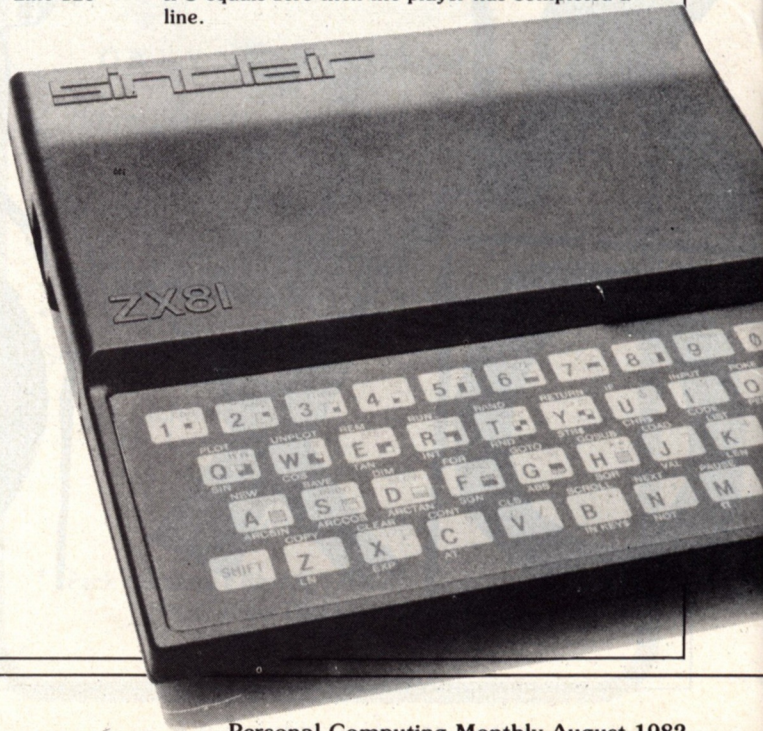
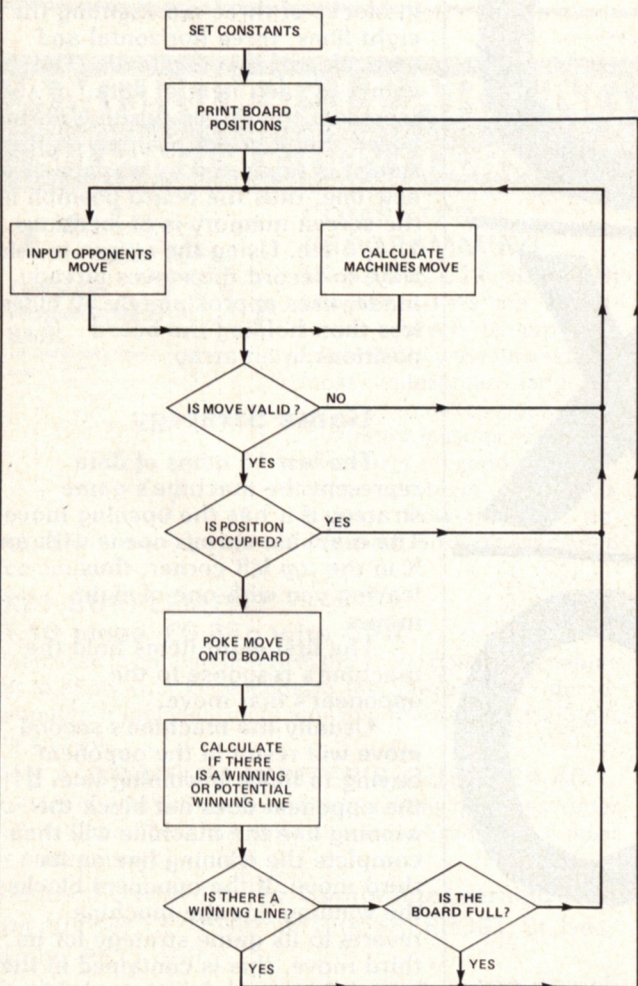
replaced by a REMark statement, so the machine never uses its predetermined game strategy. The reason for this is that when anyone has played the game as it stands they have quickly rejected it because it always wins and therefore it is no longer a game. Also for novices the machine without the game strategy will then provide a patient opponent that is capable of beating the unwary and enable the novice to work out for himself how to win consistently at the game without mechanically copying the machine's game strategy.

HOW IT RUNS

Description Of Program

Line 1 REMark statement holding data
Lines 5 - 15 Sets constants
Line 20 Clears screen
Line 25 Clears winning position string
Lines 30 - 40 Prints board
Line 45 Start of loop to count moves
Line 50 Reversible line to alternate players
Line 52 If opponents move, input move
Line 54 If second move, store value

Line 56 Jump to check for valid move (if it is the machine's move the value held in C will never be valid)
Line 61 Machine's strategy if it has the opening move
Line 65 If it is not the machine's opening move then the machine's move is random
Line 70 Check for potential winning line (machine first, then opponent) and try
Line 75 Remove tried potential winning position from W\$
Line 80 Check for valid move
Line 85 Check if board position occupied
Line 90 POKE valid move to board
Lines 95 - 140 Check for winning or potential winning lines and if the board is full
Line 95 A takes the value of each location of a line from the REMark statement
Line 100 Clears S
Line 105 C takes the value of each location of a line from the REMark statement
Line 110 In each line, if the board position does not contain the players' symbol (X or O), the code value of the board position is added to S
Line 120 If S is less than 38 (code equivalent of character 9, or less) then S is the position of a potential winning line and is added to the end of W\$
Line 125 If S equals zero then the player has completed a line.



PROGRAM LISTING

```

1 REM 2,4,6,8,10,12,14,16,18,2,8,14,4,10,16,6,12,18,2,10,
  18,6,10,14,5,7,5,9,3,3,5,3,7,9,2,7,7,9,7,7, (USE THE
  CHARACTER REPRESENTATION OF THE GIVEN
  CODES)
5 LET P=17159
10 LET Q=16514
15 LET M=61
20 CLS
25 LET W$=" "
30 PRINT "1 2 3"
35 PRINT "4 5 6"
40 PRINT "7 8 9"
45 FOR K=1 TO 9
50 LET M=113-M
52 IF M=52 THEN INPUT C
54 IF K=2 THEN LET R=C
56 GOTO 80
61 LET C=(K=5 OR K=3)*PEEK(Q+10+4*K+R) OR
  K=1
65 IF C=0 THEN LET C=INT(RND*10)
70 IF W$<>" " THEN LET C=CODE W$-28
75 LET W$=W$(2 TO )
80 IF C<1 OR C>9 THEN GOTO M
85 IF PEEK(P+2*C)>37 THEN GOTO M
90 POKE P+2*C,M
95 FOR A=Q TO Q+21 STEP 3
100 LET S=0
105 FOR C=A TO A+2
110 IF PEEK(P+PEEK C)<>M THEN LET S=S+PEEK
  (P+PEEK C)
115 NEXT C
120 IF S<38 THEN LET W$=W$+CHR$ S
125 IF S=0 THEN GOTO 20
130 NEXT A
135 NEXT K
140 GOTO 20

```

HINTS ON CONVERSION

A difference between ZX80 and ZX81 is the way they do Boolean algebra. Line 50 is a reversible line and alternates the players, its equivalent on the ZX80 is:

$LET M = M = X AND O OR M = O AND X$

where X and O represent their code values, 61 and 52 respectively. This statement simply does not work here. On the ZX81 if the argument ($M = X$ or $M = O$) is true then the function ($LET M =$) is set to one, if the argument is false the function is set to zero. There are ways round this problem, so that values other than one or zero can be assigned to the function.

In line 61, by enclosing the argument in brackets and then multiplying it, the function can be assigned a value not equal to one if the argument is true. For some reason this process only works if the argument(s) enclosed in brackets includes the first argument. In line 61 the argument $K = 1$ can only assign the value one or zero to the function. Again this problem can be overcome by replacing the OR prior to $K = 1$ by +, enclosing the argument in brackets and multiplying by the desired value and enclosing the whole line in brackets. Thus if $K = 1$ is true and the value 10 is to be assigned to the function, line 61 would become:

$61 LET C = (K = 5 OR K = 3)*PEEK(Q + 10 + 4 * K + R) + (K = 1)*10$

This type of statement need not be limited to LET statements; they also work in PRINT and POKE statements. The above line could of course be written as three IF THEN statements.

In line 5, P is the address of the display file less one. It is calculated from:

$P = PEEK 16396 + 256 * PEEK 16397 - 1$

Once the program has been keyed in, the value of P should be checked. If it is not equal to 17159 a mistake has probably been made in keying the program in. No harm will be done by running the program with the wrong value of P, but moves will not be entered onto the screen.

For non ZX81 users the RND *10 in line 65 generates a random number between 0 and 10. In line 75 W(2 TO)$ strips the first character from the string and could be replaced either by TL(W$)$ or MID(W$,2)$.

List Of Variables

A = Dummy variable
 C = Current move
 K = Count for number of moves made
 M = Indicates player
 M = 52 = Opponent's move (O)
 M = 61 = Machine's move (X)
 P = Address of display file less one
 P = PEEK 16396 + 256 * PEEK 16397 - 1
 Q = Address of first character of data
 in the REMark statement in line 1
 R = Opponent's reply to machine's
 opening move
 S = Indicates winning or potential
 winning lines
 W\$ = Hold board position of potential
 winning lines.



OVER THE RAINBOW?

The end of the ZX81 is drawing near. That's the opinion of Mark Charlton who has been looking at the new ZX Spectrum in some detail for readers of Personal Computing

Clive Sinclair announced at the launch of his new 48K colour computer, the ZX Spectrum, that his company would continue to manufacture the ZX81. He said he had no plans to withdraw the ZX81, and felt it still represented the ideal introduction to computing.

This may be his belief, or wish, but I think he is wrong. Like it or not, the ZX81 is on the way out, unless Sinclair Research drop the price to £49.95, around the price the Sinclair Timex 1000 is selling in America. Why should anyone spend £69.95 on a 1K ZX81, then pay an extra £29.95 for a 16K pack, to end up with a limited, silent, black and white computer with questionable reliability, LOAD and SAVE, when for £125 he can get a computer with 16K built in, with colour and sound, and a greatly enhanced load/save capability? I suggest that very few people will bother with the ZX81, now that a computer of the quality of the ZX Spectrum is available.

Value For Money

Is it a good computer? Is it worth the money? There is no doubt that it is worth the money, whether you pay £125 for the 16K version (which gives 7K of user RAM) or the 48K version (with 39K of user RAM) for £170. The question of whether it is a 'good computer' is not so easy to answer. Apparently designed to knock the BBC Microcomputer on the head, the ZX Spectrum is certainly remarkable for the price, but you do not spend your whole time working with a computer saying 'It's great for the price' if, in fact, it is not a particularly easy computer to use.

Keying In

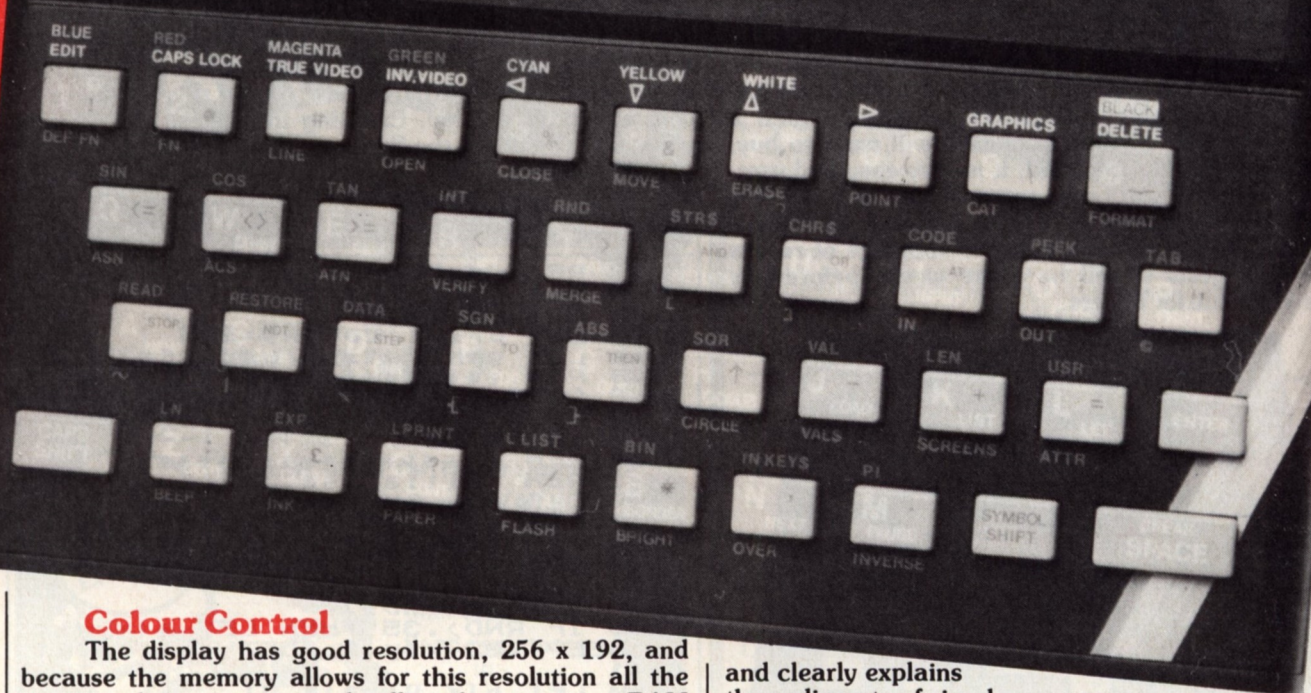
The keyboard on the Spectrum has rubber keys which depress onto a touch-sensitive keyboard. The keys are far more satisfactory to use than the ones on the ZX80 or ZX81, but they are not as good as a proper keyboard. The lack of a space bar and a shift lock would certainly make it difficult for a touch typist to master, and the fiddly 'one key entry' system means that a lot of

time is spent trying to get the function you want. To get INK, for example, which controls the colour the computer PRINTs in, you need to press the white and the red shift keys at once (yes, there are two quite different shift keys), then — while holding down the red shift key — press the X key. Three apparently unconnected actions to get a word which could be spelt out in full with three key strokes. However, I do not think this will prove a major stumbling block to most people, who will quickly become familiar with the sequence of events required to get such things as INK, PAPER (which controls the background colour) and BEEP (which produces the music from a tiny, in-built loudspeaker).

There is no doubt that most purchasers will be more than happy to live with the limitations of the keyboard and the complexities of the 'one touch entry' which puts as many as six functions on a single key, in order to take advantage of the enormous range of features Clive has packed into his new computer. Let's have a look at some of them now.

The computer runs as fast as the ZX81 did in FAST, but without losing the display as you did on the ZX81. The screen controlled by the Spectrum is memory-mapped, so much more sophisticated and satisfactory moving-graphics programs are possible in BASIC on the Spectrum than you could ever achieve on the ZX81. However, even this speed is not very fast and, coupled with the fact that everything stops if you use the BEEP command, you do not have access to the kind of speed you can get, for example, on the BBC Microcomputer or the VIC 20.

The Spectrum uses the ASCII code, a welcome decision for those of us who have had experience working with non-Sinclair micros, and for whom the Sinclair character set was a source of frustration. There is the full upper and lower case character set, and the Spectrum does not differentiate between the two, so a variable called BEH7 is the same as beh7 or BEh7.



Colour Control

The display has good resolution, 256 x 192, and because the memory allows for this resolution all the time you do not have to trade off resolution against RAM as you do on most other microcomputers. Although you can PLOT on this resolution, you can only use the colour on the same resolution as the letters, ie 32 x 22. However, this does not appear to be a problem. The colour control is better than the control of colour on the BBC Microcomputer in the teletext mode, where every colour control character uses up a space on the screen, so you cannot (on the BBC machine) have a word with every letter a different colour. This is very easy to achieve on the Spectrum. To change the colour of a word from the normal black, you just preface it — after the word PRINT — with the command INK then a number corresponding to the colour. For example PRINT INK 2; "Spectrum" will print the word in red. You can couple colour commands together (along with PRINT AT or TAB) to get, for example, PRINT AT 3,2; INK 6; PAPER 1; "Spectrum" to print the word Spectrum in yellow on a little blue strip, starting three lines down the screen, and two spaces across. You can also use INK and PAPER to change everything on the screen rather than just the line you are currently PRINTing.

Sound Command

The internal loudspeaker is triggered by the BEEP command, which is followed by two parameters — pitch and duration. The pitch 0 is middle C, and the duration 1 is one second, so BEEP 0,1 will play middle C for one second. BEEP 0,2 will play C sharp, and BEEP -1, 0 will play the B below middle C for a second. The sound command is, as you can see, very easy to use, but suffers as I mentioned earlier because it stops all other processing (including the internal clock) while it is making a noise. The output from the EAR socket is loud enough to drive a small external speaker.

There are point (PLOT X,Y), circle (CIRCLE X,Y, radius), line (DRAW x,y) and arc (DRAW x,y,z) commands to make maximum use of the resolution on the screen. These operate quickly and are very simple to use. Their easy use is enhanced by the provision with the computer of two manuals. The first, a slim volume of 30 pages, is a first-time users' introduction which simply

and clearly explains

the rudiments of simple programming. The second, meatier manual is about the size of the one which came with the ZX81, and this covers the subject in much greater depth. It is obvious that Sinclair's documentation is getting better, as is his load and save.

Loading

The most-criticised feature of the ZX81 is its unreliability when loading programs, and this is one area where a great deal of thought went into the design of the Spectrum. There is a completely different type of cassette interface, designed (so Sinclair's engineers tell me) to work with any crummy cassette recorder. 'We had a bench covered with all the cheap recorders we could get, and it worked with all of them', I was told. Certainly when I tested it, the LOAD/SAVE worked first time, a result I have never experienced with a ZX81. As well as this, the computer has a 'VERIFY' command, which means you can SAVE a program and before wiping it from the computer, play it back from tape using the VERIFY command to allow the computer to compare the program on tape with the one in its memory. You are given a clear message if the program has been saved correctly.

The greater reliability in loading is achieved in part by the fact that the program is saved in blocks. A tone leader is recorded before the actual program, and the computer uses this to set its own internal volume control to accept the program. Programs and arrays can be merged from tape (the command MERGE is available from the T key) to combine them with existing contents of the onboard RAM. This feature alone extends the computer's capabilities a great deal.

Another feature which will extend the computer is the soon-to-be-released RS232 network interface board, which is expected to cost around £20. This will enable the Spectrum to be linked with other Spectra, other computers, and other peripherals including 'foreign' printers. The ZX printer works with the Spectrum, but the 16K pack does not. In fact, Sinclair issues a warning that connecting the 16K pack to the Spectrum will damage both the computer and the RAM pack.

OVER THE RAINBOW?

Special Features

Finally, let's have a look at a Spectrum program written by Tim Hartnell to demonstrate a number of the new computer's features. Examining the listing, and then trying out the program when you get your computer will explain much of the computer's new features to you.

I believe that Uncle Clive has done it again. He has produced a splendid mass-market computer which a sizeable percentage of the population will want to buy. Apart from the 'fiddly' keyboard, it is very easy and user-friendly. My only wariness comes from the delivery times. Sinclair Research have never managed to keep to delivery schedules, and the extreme shortage of review machines suggests it will be some weeks before any become available for buyers.



How It Runs

The program, Conway's Colony, is a version of LIFE, the program first developed by John Conway who was at that time attending Cambridge University. You can see that the computer allows variable names to have spaces in them, as is shown by line 30 (where the variable is called 'print colony') and by line 40 ('generation update'). The whole program cycles from line 50 to 70, over and over again. The routine from lines 90 to 180 sets up the starting conditions. Line 135 changes the BORDER (the 'frame' around the main display area) at random, producing a quite dramatic display as the initial colony is set up. The BEEP command in line 140 shows the parameters of a BEEP can be fractions of numbers or results of a loop. This produces a splendid, constantly changing effect, as the x and y loops are executed. Note that multi-statement lines (see line 160 and line 140, for example) are possible for the first time on a Sinclair computer. They are linked by a colon, available from the Z key.

Line 250 shows a number of PRINT statements linked and the word 'Generation' in inverse letters. Inverse letters are available directly from the keyboard by holding down the white shift key, then pressing the key. Everything from then on will appear white on black.

Holding down the white shift key again, and pressing the key, will return you to normal video.

Line 345 changes the border colour at random, producing a very interesting effect which does not slow down the processing at all. The cells are printed by line 285 as an inverse little square. The colour of the square is chosen at random (INK RND*6) and this produces a very attractive display. Examining this listing should tell you quite a bit about the Spectrum.

PROGRAM LISTING

```

10 REM Conway's Colony
15 REM © Hartnell, 1982
20 GO SUB 90
30 LET print colony=200
40 LET generation update=320
45 REM *****
50 GO SUB print colony
60 GO SUB generation update
70 GO TO 50
80 REM *****
90 REM initialise
100 CLS
110 LET cells=0
120 DIM a(11,11): DIM b(11,11)
130 FOR x=2 TO 10: FOR y=2 TO 1
135 BORDER RND*7
140 IF RND>.35 THEN LET a(x,y)=
1: BEEP .02,x*y/2: LET cells=cel
ls+1
150 LET b(x,y)=a(x,y)
160 NEXT y: NEXT x
170 LET year=0
175 BORDER 7: CLS
180 RETURN
190 REM *****
200 REM Print colony
210 LET year=year+1
220 BEEP .02,RND*20
250 PRINT AT 1,0: INK RND*6;"G
eneration":year;AT 3,8;
255 LET cells=0
260 FOR x=2 TO 10: FOR y=2 TO 1
270 LET a(x,y)=b(x,y)
280 IF a(x,y)=0 THEN PRINT " "
285 IF a(x,y)=1 THEN PRINT INK
RND*6;"■": LET cells=cells+1
290 NEXT y: PRINT: PRINT: PRI
NT TAB 8;: NEXT x
292 PRINT AT 21,0: INK RND*6;"G
eneration":cells;
293 IF cells<6 THEN RUN
295 RETURN
300 REM *****
310 REM Update
340 FOR x=2 TO 10: FOR y=2 TO 1
345 "BORDER RND*6
350 LET c=0
360 IF a(x-1,y-1)=1 THEN LET c=
c+1
370 IF a(x-1,y)=1 THEN LET c=c+
1
380 IF a(x-1,y+1)=1 THEN LET c=
c+1
390 IF a(x,y-1)=1 THEN LET c=c+
1
400 IF a(x,y+1)=1 THEN LET c=c+
1
410 IF a(x+1,y-1)=1 THEN LET c=
c+1
420 IF a(x+1,y)=1 THEN LET c=c+
1
430 IF a(x+1,y+1)=1 THEN LET c=
c+1
440 IF a(x,y)=1 AND c<>2 AND c<
>3 THEN LET b(x,y)=0
450 IF a(x,y)=0 AND c=3 THEN LE
T b(x,y)=1
460 NEXT y: NEXT x
470 RETURN

```


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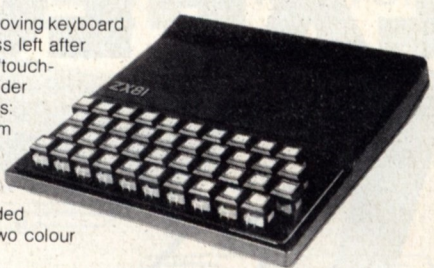
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EXPLODING SCREENS

In this easy-to-load machine code program R. Lowe shows how to make your ZX81 explode with action!

The following machine code routine will perform an almost instantaneous reversal of the screen memory which is held in the display file of your ZX81 or ZX80.

Machine Code Routine

0000	06 16	LD B,16 _H	; Value loaded into ; B is the number of ; lines to be ; reversed
0002	ED 5B 0C 40	LD DE,(400C _H)	; Location of display ; file
0006	13	LOC INC DE	; Get character ; from display ; location
0007	1A	LD A,(DE)	; Is character a ; newline character
0008	FE 76	CP 76 _H	; If it is, leave it ; alone
000A	28 05	JR Z, NEWLNE	; Reverse character
000C	C6 80	ADD A, 80 _H	; Return character ; to display location
000E	12	LD (DE),A	; Go to next ; character
000F	18 F5	JR LOC	; Check for end of ; display
0011	10 F3	NEWLNE DJNZ LOC	
0013	C9	RET	

The value put into the B register (the first instruction) can be altered to reverse only parts of the screen. If B is loaded with 0B_H, then only the top half of the screen will be reversed, for example.

Those of you with a ZX80 can change the value to 18H to reverse all 24 lines on the display.

This effect has many uses, the most obvious of which is a 'flashing' action if called at least twice in rapid succession. The sudden change from a black on white display to a white on black display, and back again, is ideal for producing explosion effects during your favourite 'Star Trek' game!

If the routine is called on a 1K ZX81 or on a ZX80 (with or without memory expansion) the only sections of the display which will reverse are those actually written to. However, on a ZX81 fitted with the 16K RAM pack, the display file is 'padded out' to its full size, and calling the routine will now produce a reversal of the whole display area, whether anything has been written to it or not.

In the ZX81, machine code routines can be easily loaded into a protected area at the top of memory. Below is a method of loading in the routine. Those of you with a ZX80 will have to POKE the routine into an area of memory (such as a REM statement or an array) which you must make available for the purpose (and arrange to be protected).

The following shows how to load the routine into a 1K ZX81. Commands needed to implement it on an expanded machine are shown in brackets.

First, get into command mode and type:-

```
POKE 16388, 236 (POKE 16388,236)
POKE 16389, 67 (POKE 16389, 127)
NEW
```

Each line should be executed individually using the NEWLINE key. RAMTOP has now been changed to 17388 or 32748. Now type in the following program.

```
10 DIM Y(20)
20 FOR N = 1 TO 20
30 PRINT N; " [2SPC]";
40 INPUT J
50 LET Y(N) = J
60 PRINT Y(N)
70 NEXT N
```

RUN the program, and input the following values, one value each time the prompt cursor appears

6, 22, 237, 91, 12, 64, 19, 26, 254, 118,
40, 5, 198, 128, 18, 24, 245, 16, 243, 201

MICROSPOT

Now type the following lines (do not type NEW):-

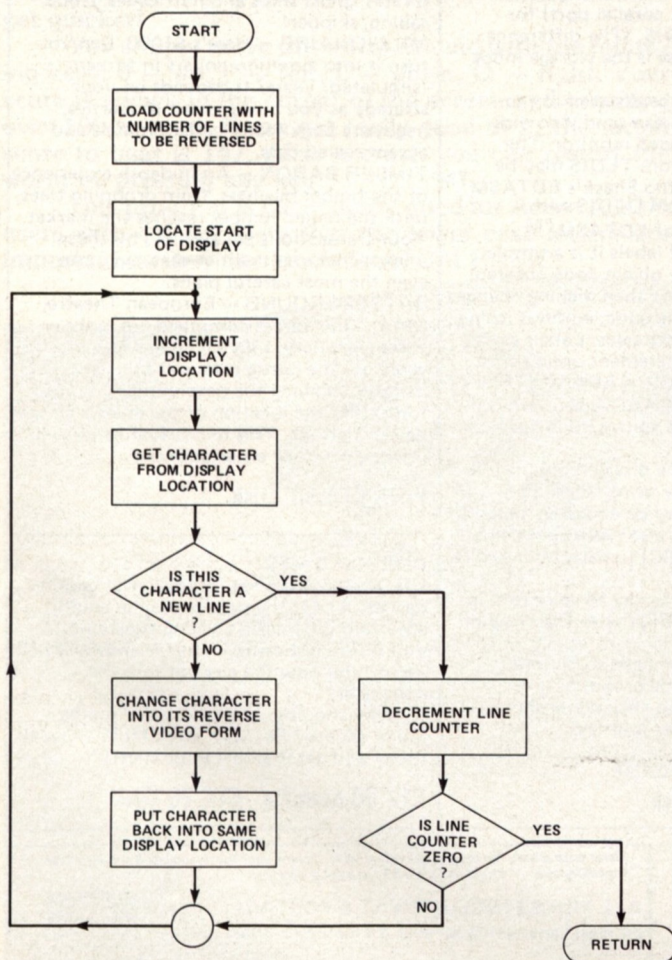
```
10 LET N=1
20 FOR X=17388 TO 17407 (20 FOR X = 32748 TO 32767)
30 POKE X, Y(N)
40 LET N=N+1
50 NEXT X
60 NEW
70 SAVE "REVERSE SCREEN"
80 GOTO 10
```

Now, set your tape recorder up and start running in Record mode.

Type GOTO 70 and press NEWLINE.

The program will save itself on tape. When it has done so it will execute itself and then 'self destruct'. You now have the machine code routine held in protected RAM. The program can be called at any time by using (for example) LET A=USR 17388 (or USR 32748 on a 16K ZX81). Only switching off the ZX81 will wipe it out (NEW does not affect it). Whenever you load the program off tape for future use, it will automatically run and 'self destruct' on completion.

Before you load the program, change RAMTOP with the two POKE commands and the NEW command as shown before the start of the BASIC program.

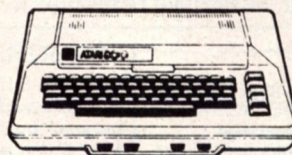


Microspots are our regular "quick-action" program hints. They are designed to be short, useful and adaptable. However, they are not necessarily aimed at the complete beginner and therefore we advise readers to read through each very thoroughly before attempting to enter and use the program.

We will pay £20 for each Microspot submitted by readers that makes it into print! Address your envelope to "Microspot, Personal Computing, 145 Charing Cross Road, London WC2H 0EE". Keep 'em short and keep 'em coming!

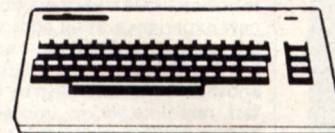
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PC/8/82

WORM!

Instant ATOM action with this compulsive game from A.P. Morris. See how you do against the hungry worm!

'WORM' is a game program for minimum memory Acorn ATOM users and entails steering a worm, which continually grows, across your screen without stopping, going over yourself or hitting the blocks. As the Worm grows the game gets harder, and your reactions have to get quicker!

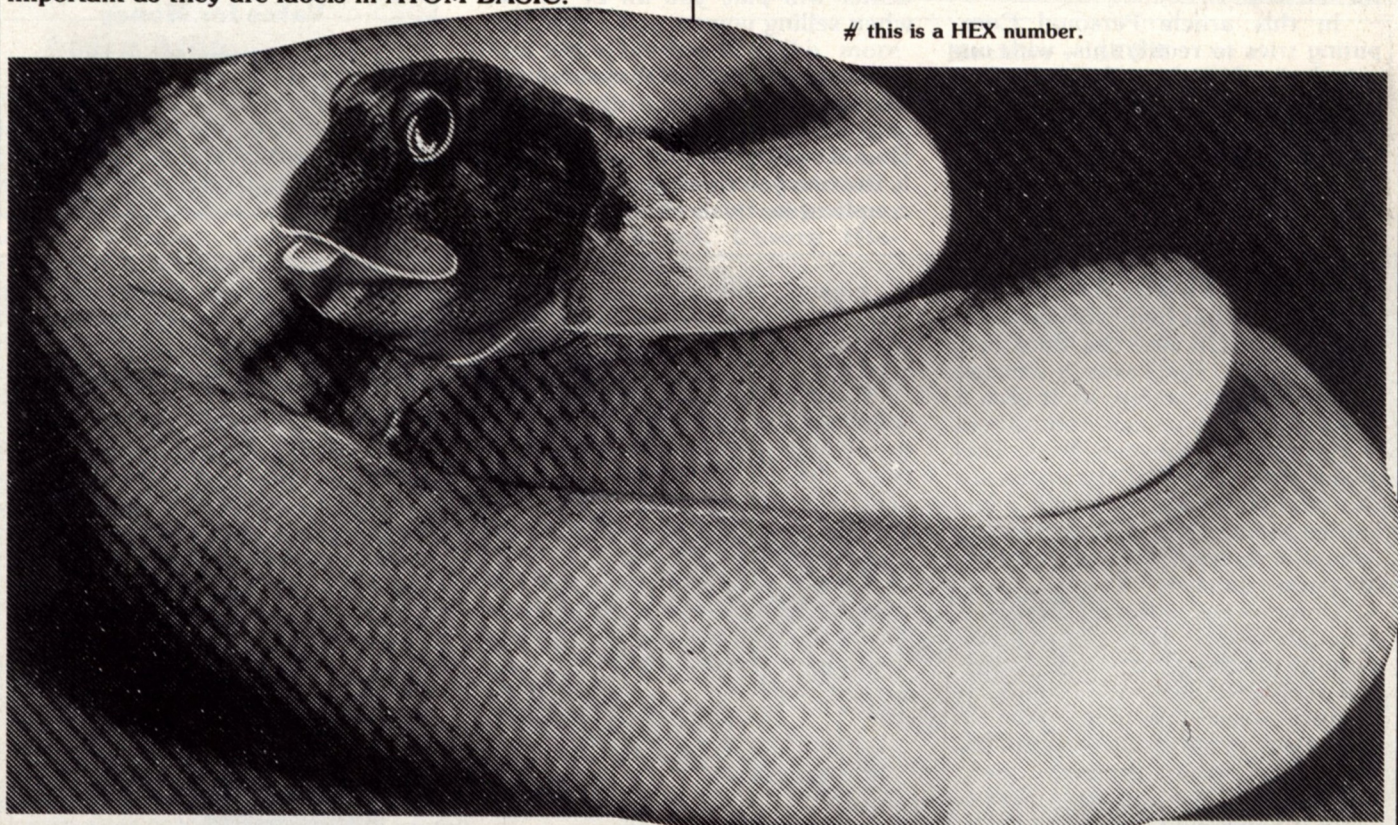
You simply move the worm around with the following keys: O — up, P — left, L — down, O — right. Your score is shown in the corner of the screen and anything over 100 is good. If you get really good at it, the target score to beat is 147. After a crash you can restart the worm by pressing any key.

This program is particularly good for Acorn ATOM users with colour. Note that the lower case letters are important as they are labels in ATOM BASIC.

```

0 REM***WORM***A.P.M. ***
27*2*81***
10 bK = #B000;L = K + 1;X = 16;Y = 8;C = 272;B =
  #8000;D = 0;P.$12;@ = 0;? E1 = 0
100 aZ = 0;DOZ = Z + 1;?K = 3;IF?L < 255Z = 20;Y = Y - 1;IF
  Y < 0Y = 15
110 ?K = 1;IF?L < 255Z = 20;X = X + 1;IFX > 31X = 0
120 ?K = 5;IF?L < 255Z = 20;Y = Y + 1;IFY > 15Y = 0
130 ?K = 2;IF?L < 255Z = 20;X = X - 1;IFX < 0X = 31
140 U.Z = 20
150 A = (Y*32) + X;IFB?A = #52ORB?A = 255G.c
160 B?A = 42;B?C = #52;C = A
170 R = A.R.%512;IFR?B < > 32G.170
180 B?R = 255;D = D + 1;P.$30D;F.Z = 1TO10;WAIT;N.;G.a
190 cP.$7$7$7;LINK #FFE3;G.b
200 END
  
```

this is a HEX number.



Microspots are our regular "quick-action" program hints. They are designed to be short, useful and adaptable. However, they are not necessarily aimed at the complete beginner and therefore we advise readers to read through each very thoroughly before attempting to enter and use the program.

We will pay £20 for each Microspot submitted by readers that makes it into print! Address your envelope to "Microspot, Personal Computing, 145 Charing Cross Road, London WC2H 0EE".

Keep 'em short and keep 'em coming!

12 OF THE BEST

Looking for a new micro or maybe just looking? Get to know twelve of the most popular machines on the market with our reviews and ratings.

Buying a computer these days is becoming increasingly more complicated, due to the ever widening choice of machines. Our Factfile section alone carries details of twenty-six computers under £1000 and excludes kits and "evaluation" boards designed for industry use.

Before the end of this year, at least three major new launches are planned, all under £500. In all probability there will be more, as companies strive to fill the seemingly insatiable demand for microcomputing hardware.

Strangely, with the computer market growing so rapidly, one thing that has remained in short supply is information, from anything other than the manufacturers themselves.

In this article Personal Computing tries to rectify this, with our round-up of twelve of the leading machines on the market. We tell you their respective strength and their weaknesses.

We have had our panel of experts, drawn from right across the

microcomputing business, rate the machines for specific qualities.

What are they like as a first machine? How good for games? What about software 'back-up' - how many programs are available for you to run? We hope this article will help you decide to on a micro to suit your particular needs.

Ratings have been done on a percentage basis, marking out of 100 on each of the attributes concerned. Have a look down the tables and see which of the machines best suits your requirements.

With the number of dealers around now, it should be possible to wander in and get a 'hands-on' demonstration of your shortlisted micros, just as any decent hi-fi dealer will play you an LP or two when selling you an audio system.

Don't be afraid to ask for a demonstration of your intended purchase. Computers represent a substantial investment and you should be prepared to try out not only the one you *think* you want, but a couple of its rivals, too.

REVIEW RESULTS SUMMARY

Suitability as First Computer

1.VIC-20 ZX-Spectrum	92%
3.ATARI 400	86%
4.Acorn ATOM ZX81	84%
6.Sharp MZ-80A	82%
7.Texas TI99/4A	80%
8.Commodore Pet Sharp MZ-80K	78%
10.BBC Model A	64%
11.Video Genie	52%
12.Tandy TRS-80 Model 1	48%

Value for Money

1.ZX-Spectrum	100%
2.ZX81 VIC-20	92%
4.Acorn ATOM	88%
5.BBC Model A	76%

TEXAS TI 99/4A

The TI 99 has had three incarnations in the UK and the third is a worthy effort. The Texas is unusual in its hardware set-up, as it uses a 16-bit central processor unit instead of the almost universal 8-bit. This means that, in theory, the processor can deal with twice as much information in any given time and so the computer as a whole should be able to operate quicker.

Unfortunately, the TI 99/4A is actually slower than most competitive machines! For all intents and purposes, the speed is such that a user would not be able to distinguish in operation between the Texas and any 'ordinary' 8-bit machine. The whizz-kids will condemn it nonetheless!

As a unit the 99/4A comes with 16K of RAM, magnificent manuals and BASIC tutors, inputs for tape, cartridges, joysticks, and other expansions. Its unique version of BASIC has a good set of commands

to control the colour. No tape recorder is included in the price - so bear that in mind when planning a budget.

Program back-up for the Texas is limited, but what there is seems to be of high quality. For its asking price, the TI 99/4A offers a great deal - a full-size keyboard, colour output, good BASIC, good expansion possibilities, etc, etc.

One thing you're never short of with the TI 99/4A is boxes. A complete system would comprise no less than eight, including the TV!

Address: Texas Instruments Ltd., Manton Lane, Bedford, MK41 7PA.

Price: Around £300 (16K RAM).

Machine - TEXAS TI 99/4A

Suitability as First Computer	- 80%
Ease of Operation	- 60%
Value for Money	- 40%
Graphics Capability	- 94%
Suitability for Games Programs	- 64%
Quality of Manuals Provided	- 62%
Suitability for Business Use	- 4%
Software 'Backup'	- 42%



ZX-Spectrum

The newest machine in our line-up. "Uncle Clive's" latest creation sets a price level which others will find hard to reach. For £125 he is offering a 16K full-colour computer and for £175 you can get four times that memory into the box!

Almost inevitably the Spectrum calls into doubt the continued existence of the ZX-81, as the price is not *that* different, once you add-on the cost of the extra memory.

The Spectrum retains the 'single-key' BASIC of the ZX-81, but provides more commands in the language and more facilities. The keyboard is an improvement over the earlier machine, but is still not a standard unit. In addition, there is a built-in loudspeaker and a good set of commands available to use it.

Overall early impressions of the Spectrum are that it will be hard to beat for anywhere near the price. Long term reliability has yet to be proven, but with all Sinclair's marketing expertise behind it you are sure to be sorely tempted to buy a Spectrum over the coming months!



Check our review of the Spectrum elsewhere in this issue.

Address: Sinclair Research Ltd, 6 Kings Parade, Cambridge, Cambs, CB2 1SN.

Price: £125 with 16K RAM, £175 with 48K (Mail order only, no dealers).

Machine - Spectrum

Suitability as First Computer	- 92%
Ease of Operation	- 40%
Value for Money	- 100%
Graphics Capability	- 72%
Suitability for Games Programs	- 82%
Quality of Manuals Provided	- 84%
Suitability for Business Use	- 10%
Software 'Backup'	- N/A

Acorn Atom

A very popular machine the ATOM. Rightly so in our opinion. It has great versatility and the ability to produce colour displays with high resolution graphics.

The basic machine is "black and white", however, and is a little restricted in the amount of memory available to the user. Expansion is cheap, though, and there is an enormous amount of programs readily available, from a wide range of dealers.

One thing to beware of is the BASIC used on the ATOM. It is anything *but* standard. Although very useful, it is so unlike most other micro BASICs that converting programs from magazines and friends is, to put it mildly, troublesome!

We have been reliably informed, however, by ATOM users that using the machine is like riding a bike, once you've worked it out it's dead easy!

Acorn have just launched an upgrade for the ATOM - full BBC specification BASIC! This comes on two chips which plug into your ATOM board and give the option of ATOM BASIC or BBC BASIC, at the press of a switch.

The main advantage is that the BBC version is much closer to the

usual BASIC and is much more capable than ATOM's own. In addition you will then be able to use all the programs worked out and marketed for the BBC Micro and more software is *never* a bad idea!

Address: Acorn Computers, Fulbourne Road, Cherry Hinton, Cambridge.

Price: £150 built, £135 in kit form. Basic unit has 2K of user RAM. BBC BASIC costs £45.

Machine - ATOM

Suitability as First Computer	- 84%
Ease of Operation	- 60%
Value for Money	- 88%
Graphics Capability	- 96%
Suitability for Games Programs	- 82%
Quality of Manuals Provided	- 70%
Suitability for Business Use	- 24%
Software 'Backup'	- 94%



12 OF THE BEST

BBC Microcomputer

Launched with the greatest advance interest ever seen to help it along, the BBC Micro has, so far, been plagued by difficulties. The order book was well and truly full long before a single machine rolled off the production lines. This has inevitably led to delays in supply, which are only now clearing. The price has been raised considerably taking the machine out of the "good value for money" category.

There are two versions available, the A and the B. The former is intended as a downmarket 'first-timer's' micro, with 16K of user memory and the well thought-out BBC BASIC to offer.

The B is the 'heavy'! It will run discs and printer and has more outputs than most people would ever need. Mechanically both versions are superbly made and both offer the incredible multi-mode graphics set-up, which enables you to decide for yourself the quality and resolution of the full-colour display.

Herein, however, lies a major drawback. To use the best graphics available you have to give up 10K of your memory. The computer itself takes 3K more for its operating con-

trol system. On the Model A this leaves you with just under 3K to put your programs into!

Effectively, therefore, the 16K BBC Model A has no more usable memory than, say, a VIC-20 when using the best graphics mode.

A point to be aware of when choosing your machine is that manufacturers specify the amount of user memory available in several different ways.

Make sure you find out exactly how much RAM is able to accept user programs.



Address: BBC Microcomputer Systems, P.O. Box 7, London W3 6JX.

Price: Model A (16K) £299
Model B (32K) £399.

Machine - BBC Model A

Suitability as First Computer	- 64%
Ease of Operation	- 52%
Value for Money	- 76%
Graphics Capability	- 94%
Suitability for Games Programs	- 84%
Quality of Manuals Provided	- 48%
Suitability for Business Use	- 42%
Software 'Backup'	- 16%

Sharp MZ-80K

The Sharp has never somehow managed to achieve the notice it deserved. For anyone writing their own games or other graphics orientated programs the Sharp is well-nigh unsurpassed.

It has 25 (three-function) graphics keys on the keyboard, another 25 graphics symbols on the letter keys (as 'shift' characters) and an upper/lower case letter capability. The standard Sharp now offers 48K of memory built-in, along with the screen and tape machine, so there is nothing more to buy, or use, in order to run programs. At the moment Sharp are launching the MZ-80A, which will eventually take over from the MZ-80K.

This means that you can pick up an 80K for around £320 complete at the moment - and that makes it the bargain of the year!

Against the Sharp is the fact that the keyboard is not a standard item and so anyone who is used to typing will find it awkward to use.

There is a good selection of software on the market and an active users club.

A very versatile machine and one which would normally be an expensive way to begin BASIC

bashing - but at the moment a real value-for-money contender for your cash.

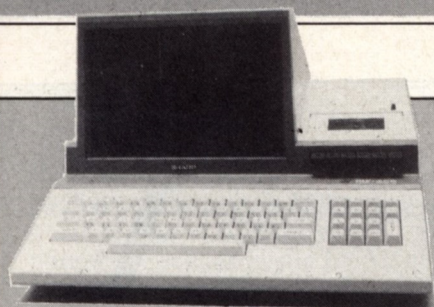
Address: Sharp (UK) Ltd, Thorp Road, Newton Heath, Manchester, M10 9BE.

Price: Around £320. Shop around for best deal. Comes with 48K of user memory.

Machine - SHARP MZ-80K

Suitability as First Computer	- 78%
Ease of Operation	- 90%
Value for Money	- 92%
Graphics Capability	- 78%
Suitability for Games Programs	- 84%
Quality of Manuals Provided	- 50%
Suitability for Business Use	- 44%
Software 'Backup'	- 86%





MZ-80A

The latest release from Sharp, following the PC 1500 hand-held 'computer' is the long-awaited MZ-80A. This is a direct competitor with the PETs and Tandy IIIs of this world, being one of the few machines on the market to arrive at its new home with tape machine and visual display unit built-in.

A development from the MZ-80K the new model has a standard typewriter keyboard (the MZ-80K was widely criticized for its lack of one) with a full set of graphics characters 'on-key'. This remains the strong point of Sharp, in that writing programs using graphic displays is made much easier by being able to get at the symbols used more readily.

If you are producing a border around an area, for example, and wish to use a pretty pattern, then looking up the graphic in a manufacturer's table and dutifully inserting the code into your program is a lot more work than simply pushing the key with the pretty patterns marked across it!

The 80A costs somewhere around £500 and is thus a very expensive 'first-time buy'. As with the Commodore PET, however, you should consider the machine as a whole — no need to tie up the living room and TV, or to purloin the family cassette recorder.

If you are serious about computing you should take a long look at the more powerful (and expensive) option represented by the Sharp, PET and BBC Model B machines. The latter must be considered expensive for what it offers in comparison but does have the best graphics ability of the lot.

Address: Sharp (UK) Thorn Road, Newton Heath, Manchester M10 9BE.

Price: Around £540 with 48K of user memory (RAM).

Machine — Sharp MK-80A

Suitability as First Computer	— 82%
Ease of Operation	— 80%
Value for Money	— 70%
Graphics Capability	— 78%
Suitability for Games Programs	— 76%
Quality of Manuals Provided	— 48%
Suitability for Business Use	— 64%
Software 'Backup'	— (N/A)

Tandy TRS-80 Model I

In some ways now the Tandy must be considered a slightly old fashioned machine, with its relatively limited choice of graphics characters, black and white screen and 'lots of boxes' approach.

There are now four Tandy computers, including the new-ish Tandy Colour Computer, which goes a long way to answering the questions now being asked of the TRS-80 Models.

The Tandy can work with a full system of printer and discs, for those who what to make their micros work for their living. The amount of software available is prodigious and across a very wide range, from Space Invaders to word processors.

You should see the TRS-80 for yourself if you're buying a micro, as

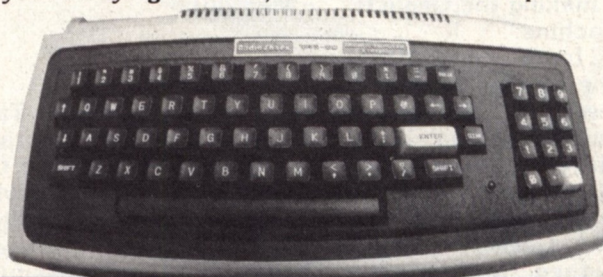
it appeals strongly to a lot of people and has that very good software back-up, along with the national dealer network of Tandy shops, who can supply expansions and programs.

Address: Tandy Corporation 12th floor, Tameway Tower, Bridge Street, Walsall.

Price: £229 (4K RAM): £339 (16K).

Machine — TRS80 I

Suitability as First Computer	— 48%
Ease of Operation	— 44%
Value for Money	— 46%
Graphics Capability	— 20%
Suitability for Games Programs	— 20%
Quality of Manuals Provided	— 88%
Suitability for Business Use	— 22%
Software 'Backup'	— 76%



VIC-20

Commodore ventured into low-cost computing with the VIC and early indications were that they had made a very shrewd move. The VIC-20 quickly established itself as an excellent first-time buy, with full-colour coming as standard.

As time has gone by, that position has been strengthened by the addition of a vast software library for VIC, making use of its colour and games capabilities.

The VIC has a slot to accept 'cartridges' as opposed to tapes (which are also catered for) which means that games, etc, which require more memory than the machine has can still be run, because the memory can be in the cartridge!

Expanding a VIC-20 is not the easiest thing in the world, because of the way its internal memory is laid out, but this is unlikely to bother

a first time buyer. One advantage the VIC-20 has over some of its rivals is the BASIC it uses — a scaled-down PET language — which is flexible and easy to use.

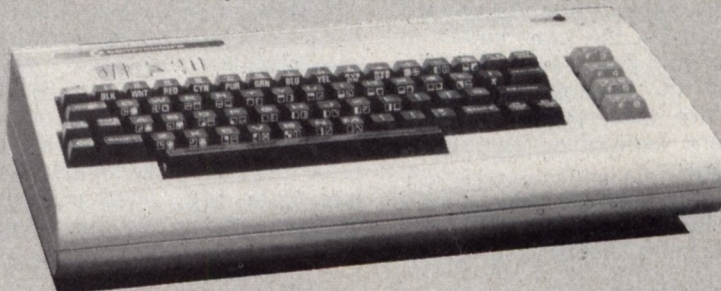
The VIC-20 represents a very attractive first-time buy and is likely to remain so for some time being both easy to operate and well supported by software companies.

Address: Commodore, Baker Street, High Wycombe, Bucks.

Price: Around £180 with 3K of user memory (RAM).

Machine — VIC-20

Suitability as First Computer	— 92%
Ease of Operation	— 92%
Value for Money	— 92%
Graphics Capability	— 82%
Suitability for Games Programs	— 90%
Quality of Manuals Provided	— 40%
Suitability for Business Use	— 22%
Software 'Backup'	— 64%



12 OF THE BEST

VIDEO GENIE

There are so many similarities between the Genie and the Tandy TRS-80 Models that it doesn't take a Mastermind to figure that there must be some connection. There is. The Genie is a copy of the Tandy!

It originated in those inscrutable Far Eastern places wherein such things are done, and even managed to improve over the original by having a built-in tape deck! The interface for this to the computer proved to be unreliable, however, and the latest model, the Genie II uses 'domestic tape', ie, does not come with tape deck.

The hole in the case left by removing the tape is filled with a numeric keypad, useful for entering machine code, amongst other things. The tape circuitry is vastly improved also, making the Genie II an attractive machine.

It suffers from the same drawbacks as the Tandy, in that the graphics are described by manufacturers as 'medium definition' — ie pretty limited in comparison with other machines.

Don't forget though that the TRS-80 and the Genie were not primarily designed for games-playing home enthusiasts, and their graphics and text handling reflect the more serious intentions of the designers.

Because it is entirely software



compatible with the Tandy, the Genie can run any program written for the TRS-80 and thus Genie programs are in great supply!

Since the tape is built-in (Genie I) it is a little easier to use than the Tandy and is possibly better presented as a whole.

Address: Lowe Electronics, Chesterfield Road, Matlock, Derby, DE4 5LE.

Machine — Video Genie

Suitability as First Computer	— 52%
Ease of Operation	— 48%
Value for Money	— 48%
Graphics Capability	— 20%
Suitability for Games Programs	— 20%
Quality of Manuals Provided	— 88%
Suitability for Business Use	— 24%
Software 'Backup'	— 76%

Price: Around £280 with 16K.

ZX-81

Clive Sinclair's world-beating £70 computer needs no introduction. It has outsold every other machine in history and introduced some 300,000 people to the subject of computing. On value for money terms, the ZX-81 is practically beyond criticism. As a computer, however, it has its drawbacks!

The keyboard is cramped and difficult to use. Several 'shifts' are required to get at some of the functions. The BASIC it uses is completely unique and is such that anyone moving up from the ZX-81 to a bigger machine might have to take time adjusting.

The graphics capabilities are limited in all but the most expert of hands, so first time users will face obstacles in producing screen displays are interesting as some other more expensive, computers can manage.

There exists also a huge "ZX-81 Economy" composed of companies who fashion a living exclusively

from producing software cassettes and bits of hardware to hang-on the back of the ZX-81. This means that any purchaser can be assured of always having games to play, routines to run and other ways to spend money!

Having said all that, though, you have to return to the price. Sixty-nine pounds is amazing for any computer and with the low-cost add-ons available, and taking into account the excellent manual and BASIC tutor provided, the Sinclair ZX-81 has to be considered a very good buy for anyone wishing to make a first step into computing.



Address: Sinclair Research Ltd, 6 Kings Parade, Cambridge CB2 1SN.

Price: £69.95 with 1K of user memory.

Machine — ZX81

Suitability as First Computer	— 84%
Ease of Operation	— 36%
Value for Money	— 92%
Graphics Capability	— 22%
Suitability for Games Programs	— 58%
Quality of Manuals Provided	— 98%
Suitability for Business Use	— 16%
Software 'Backup'	— 94%

ATARI 400

The launch of ATARI's two home computers has caused a certain amount of surprise at their price level in the UK. They are considerably cheaper in the USA.

Nevertheless, the ATARI 400 is a fine little computer and one well suited to a first purchase. It has a 'pressure sensitive' keyboard, ie. the ZX-81 type. This example is considerably more positive than the Sinclair, however, thus making it easier to use.

The 400 can produce up to sixteen different colours, in a choice of up to 8 brightness levels. In addition there are no less than four sound generators. Graphics are produced in a 'multi-mode' fashion which allows the user the choice of high resolution (up to 320 x 192 screen positions).

In addition to the usual tape input/output for programs, the ATARI computers both have a cartridge slot, similar to the VIC-20, so that complete programs and extra memory can be plugged straight in. Joystick controls can also be added for the inevitable games playing!

At around £400 the ATARI 400 is a fairly expensive machine by today's standards, but it is one which has a lot to offer the newcomer to computing. Hopefully ATARI will bring the price down to a more reasonable level, allowing the 400 to



compete more equally with the other small computers.

Address: Atari UK Ltd, PO Box 59, Alperton Lane, Wembley, Middx, Tel: 01-998 8844.

Price: Model 400 (16K) £400: Model 800 (32K) Around £650.

Machine — ATARI 400

Suitability as First Computer	— 86%
Ease of Operation	— 52%
Value for Money	— 48%
Graphics Capability	— 96%
Suitability for Games Programs	— 96%
Quality of Manuals Provided	— 48%
Suitability for Business Use	— 4%
Software 'Backup'	— 90%

PET 4000

Commodore's PET is the original home computer. The one that started it all! The original recipe has been so successful that it has varied little since the very first machines.

Modern PETs have a full-sized keyboard built-in, and the tape recorder is an external extra, where it was once housed in the PET itself. Competing with the Sharp machines, the PET is probably an excellent second computer for most people. It is very versatile, has an excellent BASIC which makes it easy to use and comes with comprehensive — and comprehensible — manuals. (The Sharp manuals by contrast are notoriously rotten!)

For a first-time buyer the PET is expensive at around £600, when you add in the cost of the tape machine (about £60). It does have a lot to offer, including that built-in TV screen which means you are getting a complete 'package' for you money.

Must be worth a good long look



if you're serious about computing, but is probably not worth spending out on at first if you're not really sure as yet. A good one to move up to!

Address: Commodore, 675 Avenue, Slough, Bucks. Telephone 75 74111.

Price: Around £600 with tape machine and 32K of usable memory.

Machine — PET 4000

Suitability as First Computer	— 78%
Ease of Operation	— 84%
Value for Money	— 56%
Graphics Capability	— 44%
Suitability for Games Programs	— 72%
Quality of Manuals Provided	— 42%
Suitability for Business Use	— 58%
Software 'Backup'	— 96%

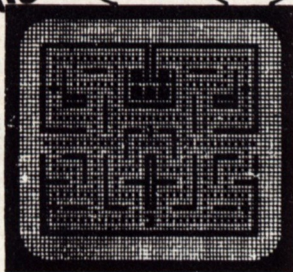
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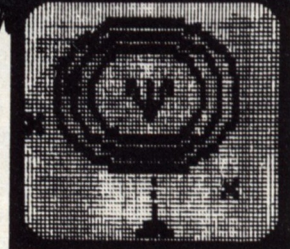
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FEATURES

- ## CENTRONICS STANDARD PARALLEL OUTPUT INCLUDES HANDSHAKING
- ## RS232 SERIAL OUTPUT FULL SPEC INCLUDES BUSY HANDSHAKING LINE.
- ## PRINTS LISTING OF BASIC PROGRAM
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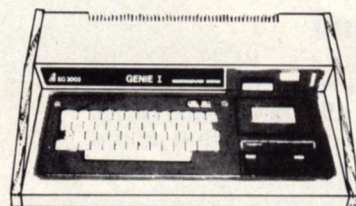
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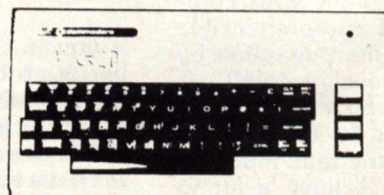
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TECHNIQUE

MAKING BETTER USE OF COLOUR ON THE VIC-20

Ever wondered how to produce multi-colour lines? Characters which change colour as they move around the screen? Chris Palmer explains how to make your VIC work harder!

The most obvious place to start adding colour to your programs is the choice of the screen (or background) colour and of the surrounding border. The first thing to consider is which colour combinations are most suited to the style of the program. For example, if it is an action game, you might use the brighter colours such as red, green or yellow or, for a board type of game, it would be a good idea to set the border colour and the screen colour the same, so as to give the impression that the whole screen is in use.

Other considerations are whether you require the person using the program to spend a lot of their time reading data from the screen. If so, then a combination of colours that are not garish but provide good definition are necessary, such as black or blue background colour and a white or yellow character colour. Also, if the program is broken down into several sections, then having a different colour combination for each section helps to emphasise the different functions of these sections.

Once you have decided on the colour combination you want to use, then next step is to decide the best way in which to implement them. If you have only one or two different combinations in a program, then it is best to just implement them directly using the POKE 36879 command and the values shown in the table in the VIC Manual. If, however, you need a greater range

of combinations, then a subroutine which caters for all these can be added to your programs pretty early. The subroutine shown in Figure 2 uses the colour values as shown in Figure 1 to calculate the POKE value for changing the colour combination automatically. The colour for the Border is carried into the routine as the variable CB and the colour for the Screen as the variable CS. If you want a purple border with a light cyan screen, you would thus set CB = 4 and CS = 11, then GOSUB to the routine, which would then calculate the value 188 and POKE the colour register with it causing the screen to change.

Border Colours	Value	Screen Colours	Value
Black	0	Black	0
White	1	White	1
Red	2	Red	2
Cyan	3	Cyan	3
Purple	4	Purple	4
Green	5	Green	5
Blue	6	Blue	6
Yellow	7	Yellow	7
		Orange	8
		Light Orange	9
		Pink	10
		Light Cyan	11
		Light Purple	12
		Light Green	13
		Light Blue	14
		Light Yellow	15

Figure 1

```

1000 REM CS=COLOUR OF SCREEN:CB =
      COLOUR OF BORDER
1010 C1=CS*16:REM SET
      SCREEN BORDER
1020 C1=C1+CB*8:REM ADD
      BORDER COLOUR
1030 POKE 36879,C1:REM POKE
      COLOUR COMBINATION
1040 RETURN
  
```

Figure 2

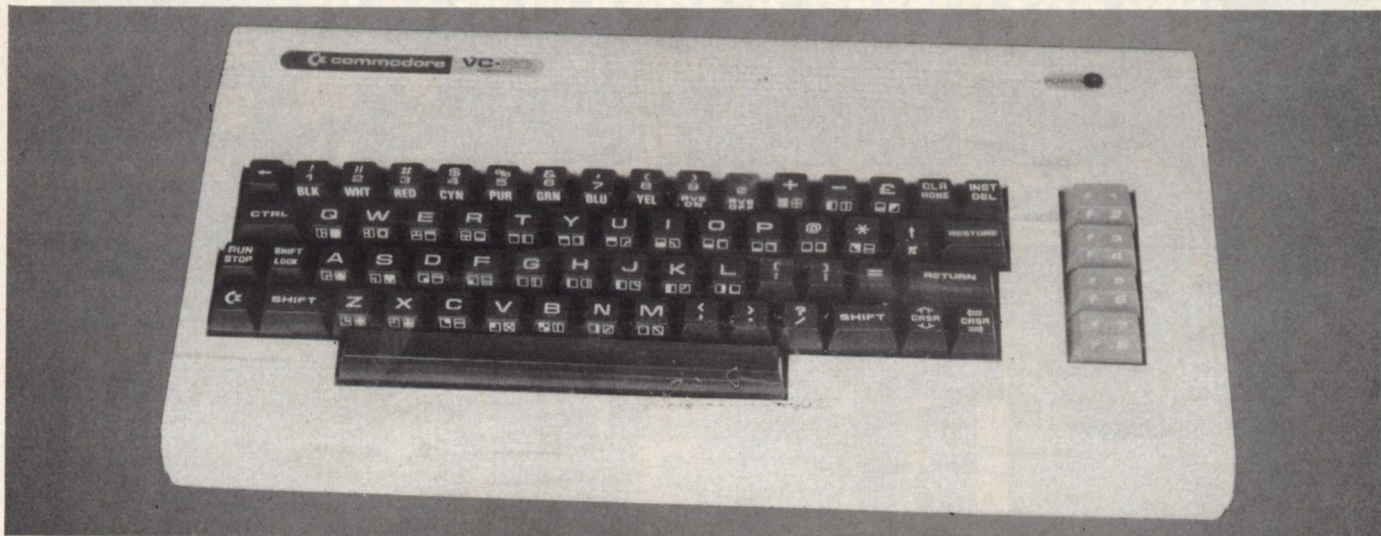
It then becomes straightforward to rotate either the border or the screen colours from within a program by setting up a FOR ... NEXT loop adding one to CB or CS each time though.

Character Colour

Having now set up the screen and border colours, select and implement the actual colours for the display. One of the problems with the VIC is that quality of its colour varies between television sets, so some colour combinations will appear blurred or indistinct on your TV; for example red lettering on a green background. The answer to this is to experiment and see which combination works best on your particular television set.

The VIC actually controls the printing colour by interpreting control codes placed within the quotes in a PRINT or an INPUT statement. When in the quote mode, these codes are generated by holding the

MAKING BETTER USE OF COLOUR



CTRL key down and pressing the keys at the top of the keyboard which are labelled with the colours. This approach works well if you are only using a few print lines directly, or if you need a lot of colour changes in one line. However, if you require more flexibility in the way your displays are coloured, (such as certain items of data displayed in a particular colour) then a systematic approach is better.

The routine shown in Figure 3 uses the colour codes 0-7 to select and print the control characters for those colours. The routine works by holding the character codes in the form of a string and then selecting the code required by using the MID\$ command. The notation [BLK] etc, used in line 1120 means hold the CTRL key down and press the BLK key; this will place the reverse field character that represents black in the quotes.

```
1100 REM CC=CHARACTER COLOUR
1110 CC=CC+1
1120 PRINT MID$(" [BLK][WHT][RED]
      [CYN][PUR][GRN][BLU]
      [YEL]",CC,1);
1130 RETURN
```

Figure 3

Using this routine means that you can directly equate numerical values to the colours that will appear on your screen. One important point to note is not to miss the semi-colon off the end of line 1120 or, whatever you print after the colour code will appear on the next line!

There is an even quicker way to change the colour of printing on the screen and that is to POKE location 646 with the colour codes from 0 to 7, as this is the place where the VIC

keeps track of the current printing colour, so when you POKE it, all the printing afterwards will appear in that colour. Other useful effects can be obtained by highlighting certain areas of text in reverse field. This is achieved by pressing the CTRL key and the RVS ON key when in 'quote' mode, before the actual text is entered.

On The Border

A way to further improve the visual impact of your programs is to place coloured borders around certain areas of the screen. The routine shown in Figure 4 uses the string handling commands to position and draw the border and a routine similar to that shown in Figure 3 to select the colour. The variable CC contains the character colour, WC and DC contain its values for 'how many characters wide' and 'how many deep' the border is, whilst TD and TR contain the values for the start position for the border in characters down and across.

One point to be aware of when using this is that if you draw a border right up to the righthand edge of the screen, the VIC will force new lines in between thus breaking up the border.

```
1200 REM CC=CHARACTER COLOUR:DC=DEPTH
1210 REM WC=WIDTH:TR=START(CHR'S RIGHT)
1220 REM TD=START(CHR'S DOWN)
1230 PRINT " ";LEFT$("XXXXXXXXXXXXXXXXXXXX",TD);TAB(TR);REM 19 CURSOR DOWN
1240 REM PRINTMID$(" [BLK][WHT][RED][CYN][PUR][GRN][BLU][YEL]",CC+1,1);
1250 PRINTTAB(TR);LEFT$(" ",WC+1);REM 20 SPACES
1260 FOR I=1 TO DC-2:PRINTTAB(TR);" ";
1270 PRINT LEFT$("XXXXXXXXXXXXXXXXXXXX",WC-2);" ";REM 20 CURSOR RIGHT
1280 NEXT
1290 PRINTTAB(TR);LEFT$(" ",WC+1);REM 20 SPACES
1300 RETURN
```

Figure 4

VIC Colour Memory

The VIC has two separate areas of memory set aside for the screen; the first starts at decimal 7680 in the memory on the unexpanded VIC and contains the information for the character displayed in that position on the screen; the second area starts at decimal 38400 in the memory and contains the code for the colour of that position.

The advantage of this is that you can change the colour of items on the screen without having to print them again. This is especially advantageous in games because you can set up areas of the screen with different colour values so that as a character moves from one area to the next it will change colour, (a similar idea was used on the early space invader machines, where the invaders changed colour as they descended — but this was achieved by sticking different colour cellophanes across the display screen!)

The codes stored in this memory are the same as the border codes shown in Figure 1. It is important to remember this split memory when POKEing characters on to the screen, because if you don't set the colour code in the memory for the

position of the character you are POKEing it will be displayed in the background colour, thus rendering it invisible!

Remember Resolution

Finally, this area of memory is also responsible for switching the display between Hi-res (the normal operating mode) and Multi-colour mode. This is achieved by POKEing a value of greater than 7 into the position in colour memory. What this does is change the way in which the VIC interprets the information found in character memory. Because this distorts the normal character it is only really useful when you are using definable character and can specify the pattern yourself.

The four combinations of colour you can now have in any one character are: Background colour, Border colour, Character colour and 'Auxiliary' colour.

The VIC retrieves the Background and Border colours from locations 36879, the Character colour from the location in colour memory and the 'Auxiliary' colour

```
10 INPUT"COLOUR OF SCREEN";CS
20 INPUT"COLOUR OF BORDER";CB
30 GOSUB 1000
40 REM MULTICOLOUR MODE
50 FORI=0TO7
60 READ A
70 POKE 7168+I,A
80 POKE 7168+(8*32)+I,0
90 NEXT I
100 PRINT"J"
110 POKE 36869,255
120 FORI=1TO50
130 P=INT(RND(1)*506+1)
140 POKE 7680+P,0
150 POKE 38400+P,10
160 NEXT I
170 FOR CC=0TO15
180 POKE 36878,
    PEEK(36878)AND 15
190 POKE36878,PEEK(36878)
    OR (CC * 16)
200 FORI=1TO500:NEXT T
210 NEXT CC
220 GOTO 170
230 DATA 5,5,5,5,175,
    175,175,175
1000 C1=CS*16
1010 C1=C1+CB*8
1020 POKE 36879,C1
1030 RETURN
```

Figure 5

from location 36878. The Character colour is set by POKEing the colour memory position with the Colour code (0-7) plus 8 in order to set that position to multicolour mode. The Auxiliary colour is set by POKEing location 36878 in the following way.

POKE 36878, PEEK (36878) AND 15
POKE 36878, PEEK (36878) OR [CC * 16]
where CC is the Colour code (0 - 15)

An example of the multicolour mode can be seen by typing and running the routine shown in Figure 5., where a defined character is set up, placed on the screen in multicolour mode and then its component colours are altered.

Conclusion

As with all programming techniques, the best way to achieve competency is to play around with them until you are completely happy in their use.

Experiment with your own programs and try out all the various combinations of colour you can get. Gradually you will find it becoming easier and easier to build up complex routines which make full use of the VIC-20's capabilities.

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**A test of skill and patience for VIC-20 owners.
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This maze game is a type of 'solitaire' which can confound you from seconds to hours.

The object of the game is to move your playing pieces, between one and five of them, so that they cover up the same number of diamonds which appear scattered around the maze.

Sounds simple, doesn't it? It will sound even simpler when you learn that the diamonds don't move during the game! Just try it and see how easy it is!

This is one of those infuriatingly difficult games that quickly becomes compulsive. With

any more than three pieces on the board it takes a great deal of thought and planning to achieve the cover up.

Your controls are A — move up, S — move down, K — move left, L — move right, Space Bar — stop. However, if you fancy changing the keys around a bit, look at lines 340 — 370 in the program and you'll see you can make the control keys any letter you like just by substituting between the quotation marks.

The rest of the game explains itself as you play, but start with



only one of two men and master that before complicating things any further.

PROGRAM LISTING

```

10 R=RND(-TI):S=36879:V=36078:DIMP(5),C(5)
20 PRINT"MAZE/2":PRINT""
BY MIKE O'NEILL:POKEV,0
22 PRINT"KEYS:":PRINT" A=UP":PRINT" S=DOWN":
PRINT" K=LEFT":PRINT" L=RIGHT"
24 PRINT" SPACE=STOP"
30 INPUT" ENTER LEVEL (1-5)":R:IFR>5ORR<1THEN30
40 IR=800-R*100:PRINT
50 INPUT" HOW MANY (1-5)":NN:NN=INT(NN):
IFNN>5ORNN<1THEN50
60 POKE36879,57:PRINT""
100 PRINT"
101 PRINT"
102 PRINT"
103 PRINT"
104 PRINT"
105 PRINT"
107 PRINT"
108 PRINT"
109 PRINT"
110 PRINT"
111 PRINT"
112 PRINT"
113 PRINT"
114 PRINT"
115 PRINT"
116 PRINT"
117 PRINT"
118 PRINT"
119 PRINT"
120 PRINT"
121 PRINT"
190 FORN=1TONN
200 P(N)=INT(RND(1)*418+7724):IFPEEK(P(N))<>32THEN200
210 POKEP(N)+30720,1:POKES,200:FORJ=1TO10
211 POKEV,0:POKEP(N),32:FORI=1TO50:NEXT:POKEP(N),01:
POKEV,15:FORI=1TO50:NEXTI,J
212 C(N)=32
220 NEXT
222 FORN=1TONN
224 CC=INT(RND(1)*418+7724):IFPEEK(CC)<>32THEN224
226 POKECC+30720,2:POKES,200:FORJ=1TO10
228 POKEV,0:POKECC,32:FORI=1TO50:NEXT:POKECC,90:
POKEV,15:FORI=1TO50:NEXTI,J:POKE
V,0
230 NEXT
300 A$=""
310 GETB$:IFB$=""THEN330
320 A$=B$:GOTO310
330 IFA$=""ANDD=0THEN405
335 IFA$=""THEN400
340 IFA$="A"THEND=-22
350 IFA$="S"THEND=22
360 IFA$="K"THEND=-1
370 IFA$="L"THEND=1
380 IFA$=""THEND=0:GOTO405
400 POKEV,15:FORI=1TO100:NEXT:POKEV,0
405 FORN=1TONN
410 CH=PEEK(P(N)+D):IFCH=32THEN420
412 IFCH<>90THEN450
414 GOTO2000
420 POKEP(N),C(N):P(N)=P(N)+D:C(N)=PEEK(P(N)):
C(N)=PEEK(P(N)+30720)
430 POKEP(N)+30720,C(N):POKEP(N),81
450 NEXT
460 FORI=1TOIR:NEXT
500 GOTO300
2000 J=0:FORI=1TONN
2010 IF(I)<>90AND(I)<>NTHENJ=1
2020 NEXT
2030 IFJ=1THEN420
2040 POKEP(N),32:P(N)=P(N)+D
2100 POKES,0:FORI=1TO100STEP3:POKES,150+I:
POKEV,15:FORI=1TO5:NEXT
2110 FORJ=1TONN:POKEP(J),32:
NEXT:POKEV,0:FORK=1TO5:NEXT
2120 FORJ=1TONN:POKEP(J),81:NEXTJ,I
3000 INPUT"ANOTHER GAME (Y/N)":
A$:IFA$="N"THENPOKE36879,27:END
3010 IFA$="Y"THEN30
3020 GOTO3000

```


HOW IT RUNS

This game uses several of the special features of the VIC-20 which make this section a little larger than usual

Line 10 Generates a random number (N), initialises variable S as the memory address of the sound device and V as the volume level. Dimensions the size of the two arrays P and C.

Lines 20 — 50 Print the introductory text and get the game level and number of pieces required.

Line 60 Sets the screen to cyan with a white boarder and white text.

Lines 100 — 121 Print the maze map onto the screen.

Lines 190 — 220 Place the circles in the maze and bleep each time one is placed.

Lines 222 — 230 As above but for the diamonds.

Lines 300 — 450

Get the pressed key character, examine it and see if it is a valid movement or stop command. If valid look at the position you wish to move to and see if it is free, if so move. If it is a diamond then record this in the correct array.

Lines 2000 — 2120

Check to see if all the diamonds have been covered. If they have wipe them out and replace with circles.

Lines 3000 — 3020

End game. Revert screen to normal colours if player has finished.

HINTS ON CONVERSION

The main areas of conversion difficulty are the way in which the screen is split into two areas of memory, one for the position and the other for the colour. The former has addresses between 7680 and 8185, the latter is located between 38400 and 38905. In virtually all other systems the second set of addresses can be ignored and omitted from the program. The first set will, of course, have to be changed to suit the memory of your system.

Any references to locations between 36874 and 36878 are concerned with the generation of sound effects and may either be changed to suit your machine or ignored.

The only other location that may cause trouble is 36879 which controls the colour of the screen and its border. In this case the code is used in Line 60 and sets the screen to cyan with a white border — the text colour is then set to white by the next command on that Line.

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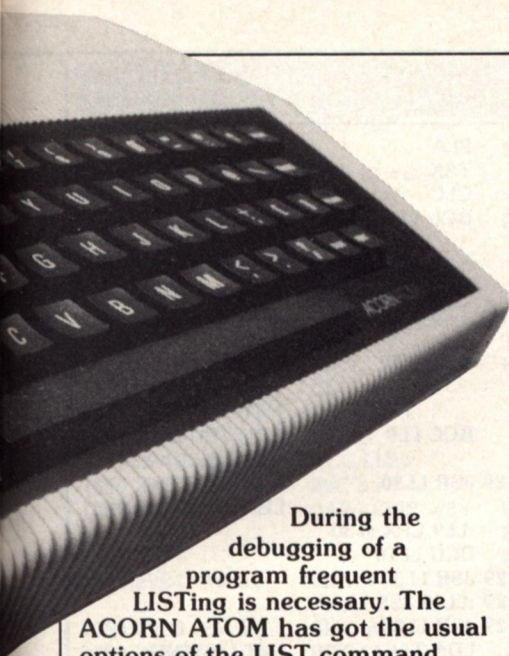
UP
UP
UP
UP
UP

DOWN
DOWN
DOWN
DOWN



AND LISTER

This ingenious ATOM program from Peter Reber can save you a lot of time at the keyboard and make life easier into the bargain.



During the debugging of a program frequent LISTing is necessary. The ACORN ATOM has got the usual options of the LIST command, such as "LIST to line x" or "LIST from line x to line y" etc. A further help is the 'paged mode' which stops any program after 16 lines have been scrolled off the VDU display. The ATOM then waits until any key on the keyboard is pressed before continuing. In this manner every section of a program listing can be inspected at your leisure.

However, you may want to study a particular part of a program but when it is LISTed in the paged mode only half of that section appears on the screen. After pressing any key the second half appears — but the first half is scrolled off the screen!

The only thing to do is to hit the "ESC"-key at the right time and stop. This necessitates the retyping of LIST if we want to check the program further.

APPLEs for ATOMs?

With the CTRL-S feature of an APPLE it is possible to stop a listing at any time as long as CTRL-S is pressed. Here is a program that not only allows you to stop a listing but to list backwards as well. After all, 16 lines of program are not that much and the ability to move back and forth in a listing would often be helpful.

List Of Explanations

First, though, you have to know exactly how the LIST command works. This program was written by establishing where the machine jumps to on LIST and then disassembling the monitor LIST program. After studying the listing it was found that the only place to change the program flow

was at the output routine, held in the machines RAM.

This program 'traps' the carriage return characters and tests if the CTRL key is pressed. If it is, then it waits for the SHIFT key to be pressed before continuing.

If the listing is stopped you can press the key 'S' and the cursor will 'fly' over all the lines on the screen while moving upwards. In fact every line is printed again, but in exactly the same place as the old one, so you only see the cursor moving. When the cursor comes to the top of the screen, the screen contents will scroll down and a new line will appear at the top. This process continues until you come to the beginning of your program where it will stop. You can escape from the LIST at any time with ESC-key. The program is fully transparent, eg the LIST command behaves in exactly the same way as usual.

How To Set Up The Program:

Relocate the text space to #2B00 (?18 = #2B). Enter the program via the keyboard. Again don't forget to type the end of assembly marker and RETURN as the last line which does not appear in the assembly listing. RUN the program, ie assemble it. Type LINK #2902, this 'revector's' the output routine. Type LIST and see how the program works. Then * SAVE the object code.

One last point. Be careful if your program uses the output routine and the CTRL-key, eg a game, because if the CTRL-key is pressed when a CR is output it would stop the program. If that happens you can press the SHIFT key and carry on since all the CPU register contents are retained.

(Memory requirements are 3K with all the REMs and comments removed.)

HOW IT RUNS

The ATOM stores a line in the same form it is written (ie ASCII format), except for the line number which is converted to a 2 byte binary number. End of line marker is a CR character 0DH. The lines are also sorted according to line numbers.

#(hash) denotes a hexadecimal number
@ means immediate addressing (for assembler)
#DE, #DF always points to the start of one of the 16 VDU lines offset from start of the VDU line. Cursor position is (? #DF * 256 + ? #DE + ? #E0)
#58, #59 list pointer. Points to the CR preceeding the next line to be printed.

After backstepping we must take care that the list pointer and the Y register have the correct values, because the first thing the monitor routine does after we return from our patch is to add the length of the last printed line (in the Y register) to the list pointer.

Line 145 & 165: Do not type these two lines. They are there only temporarily during a printout on the printer, so that I get a printout in pages and not as one long piece of paper, and work together with a program in screen memory.
Line 210: Do not forget the start of assembly marker which is not printed in the assembly listing.
Line 370: To get the cursor to the start of a VDU line.
Line 480: We don't have to worry about the return addresses and the data on the stack since the monitor resets the stack pointer.
Line 510: You can choose any key you would like. The value in operand field is ASCII — #20. SHIFT, CTRL and REPT are not detected by subroutine FE71.
Line 1040 up: Why start searching from start of text and not just from present location backwards to the next CR? The line numbers are in binary, ie one or both bytes can be #D and that would crash the program. The only way we know for sure what is "line number" and what the "end of line marker" is, is by starting the search at the beginning.

UP AND DOWN LISTER

PROGRAM LISTING

50	REM**WRITTEN FOR THE ACORN ATOM	570 2945 68	PLA	
55	REM**THIS PROGRAM ALLOWS YOU TO STOP A LISTING AT ANY TIME	580 2946 AA	TAX	
		590 2947 18	CLC	
60	REM**WITH THE CTRL KEY. YOU CAN THEN LIST BACKWARDS TOWARDS	600 2948 90 D8	BCC LL3	GOTO EXIT
		610 294A		
65	REM**LINE 0 BY PRESSING THE KEY 'S'. CONTINUE NORMAL LISTING	620 294A		**HERE ON BACKSTEP*****
		630 294A		
70	REM**BY PRESSING THE SHIFT KEY	640 294A 20 72 29	:LL8 JSR LL20	SEARCH FOR PRECEEDING LINE
75	REM**THE ESC-KEY WORKS AT ALL TIMES			MOVE CURSOR UP ENOUGH THAT NEW LINE TO BE PRINTED CAN BE INSERTED
80	REM**AFTER HITTING BREAK BRING PROGRAM BACK INTO OPERATION	650 294D E0 3E	CPX @62	X HOLDS THE LENGTH OF LINE
85	REM**WITH LINK #2902. THIS ALSO RELOCATES THE TEXT SPACE			
90	REM**TO #2B00	660 294F 90 03	BCC LL9	
95	REM*****	670 2951 20 D3 29	JSR LL30	
100	DIM LL(50); REM**SPACE FOR LABELS			
110	S = #80; T = #82; REM**POINTERS	680 2954 E0 1E	:LL9 CPX @30	
120	FOR I=0 TO 50; LL(I) = -1; NEXT	690 2956 90 03	BCC LL10	
130	PRINT \$21; REM**VDU OFF, SUPPRESS ASSEMBLY LISTING	700 2958 20 D3 29	JSR LL30	
		710 295B 20 D3 29	:LL10 JSR LL30	
140	GOSUBz; REM**ASSEMBLY FIRST PASS	720 295E 20 D3 29	JSR LL30	
145	PRINT \$2,\$6; REM**FOR HARDCOPY PRINTOUT ONLY	730 2961 A5 82	LDA T	SET LISTING POINTER TO START OF PRECEEDING LINE
150	GOSUBz; REM**ASSEMBLY SECOND PASS			
160	PRINT \$6; REM**TURN VDU ON AGAIN	740 2963 85 58	STA #58	
165	?18 = #90;G.600; REM**FOR HARDCOPY PRINTOUT ONLY	750 2965 A5 83	LDA T+1	
		760 2967 85 59	STA #59	
180	END	770 2969 20 24	2A JSR LL40	PRINT LINE OUTPUT A CR/LF
200z	P = #2902; REM**LOCATION COUNTER	780 296C 20 54	CDJSR #CD54	
210	2902 A9 2B :LL0 LDA @ #2B RELOCATE TEXT SPACE	790 296F 18	CLC	
		800 2970 90 B8	BCC LL5	GO AND SCAN KEYBOARD AGAIN
220	2904 85 12 STA #12			
230	2906 A9 11 LDA @LL1& #FF REVECTOR OUTPUT ROUTINE	1000 2972		
		1010 2972		**SEARCH FOR THE LINE PRECEEDING THE ONE PRINTED LAST**
240	2908 8D 08 02 STA #0208			
250	290B A9 29 LDA@LL1& #FFFF/256	1020 2972		S IS SEARCH POINTER, T IS TEMPORARY STORAGE
260	290D 8D 09 02 STA #0209			
270	2910 60 RTS	1030 2972		
290	2911	1040 2972 A5 12	:LL20 LDA #12	MOVE START OF TEXT TO SEARCH POINTER
300	2911			
310	2911			
320	2911 08 :LL1 PHP			
330	2912 C9 0D CMP @ #D IS CHARACTER A CARRIAGE RETURN?	1050 2974 85 81	STA S+1	
		1060 2976 A9 00	LDA @0	SET LOW-BYTE OF SEARCH POINTER TO 0
340	2914 F0 04 BEQ LL2			
350	2916 28 PLP			
360	2917 4C 52 FE JMP #FE52 NO, PRINT IT	1070 2978 85 80	STA S	
370	291A 20 52 FE :LL2 JSR #FE52 OUTPUT A CARRIAGE RETURN	1080 297A C5 58	CMP #58	DID WE BACKSTEP TO THE START OF TEXT?
380	291D 2C 01 B0 BIT #B001 IS CTRL KEY PRESSED?	1090 297C A5 81	LDA S+1	
390	2920 50 04 BVC LL4 YES - BRANCH	1100 297E E5 59	SBC #59	
400	2922 A9 0D :LL3 LDA #D RESTORE THE ACCUMULATOR CONTENTS	1110 2980 90 0F	BCC LL22	NO
		1120 2982 20 71	FE :LL21 JSR #FE71	YES, WAIT FOR KEY RELEASE
402	2924 28 PLP AND RETURN. CR IS ALREADY PRINTED			
410	2925 60 RTS	1130 2985 C0 FF	CPY @ #FF	
420	2926 8A :LL4 TXA SAVE X REGISTER	1140 2987 D0 F9	BNE LL21	
430	2927 48 PHA	1150 2989 68	PLA	PULL RETURN ADDRESS OFF THE STACK
440	2928 84 80 STY #80 SAVE Y REGISTER			
450	292A 20 71 FE :LL5 JSR #FE71 SCAN KEYBOARD	1160 298A 68	PLA	
460	292D C0 3B CPY @ #3B IS ESC-KEY PRESSED?	1170 298B A5 85	LDA T+3	MOVE LENGTH OF FIRST PROGRAM LINE TO #80 FOR EVENTUAL RETURN TO THE MONITOR PROGRAM UNCONDITIONAL, LINE LENGTH CAN NEVER BE 0
470	292F D0 03 BNE LL6			STORE SEARCH POINTER TEMPORARILY IN T
480	2931 4C CF C2 JMP #C2CF YES, ESCAPE FROM LISTING	1180 298D 85 80	STA #80	
490	2934 C0 FF :LL6 CPY @ #FF IS NO KEY PRESSED?			
500	2936 F0 06 BEQ LL7			
510	2938 C0 33 CPY@ #33 IS KEY S PRESSED?	1190 298F D0 AD	BNE LL7	
520	293A D0 EE BNE LL5 NO, SCAN AGAIN			
530	293C F0 0C BEQ LL8 YES, GO BACK IN LISTING	1200 2991 A5 80	:LL22 LDA S	
540	293E 2C 01 B0 :LL7 BIT #B001 IS SHIFT KEY PRESSED?	1210 2993 85 82	STA T	
550	2941 30 E7 BMI LL5 NO, SCAN AGAIN			
560	2943 A4 80 LDY #80 RESTORE REGISTERS			

1220 2995 A5 81	LDA S + 1		
1230 2997 85 83	STA T + 1		
1240 2999 A0 02	LDY @2	STEP OVER LINE NUMBER	
1250 299B A9 0D	LDA @ #D		
1260 299D C8	:LL23 INY	SEARCH FOR NEXT CR, END OF LINE	
1270 299E D1 80	CMP (S),Y		
1280 29A0 D0 FB	BNE LL23		
1290 29A2 84 85	STY T + 3	STORE LINE LENGTH ADD LINE LENGTH TO SEARCH POINTER	
1300 29A4 A5 80	LDA S		
1310 29A6 18	CLC		
1320 29A7 65 85	ADC T + 3		
1330 29A9 85 80	STA S		
1340 29AB 90 02	BCC LL24		
1350 29AD E6 81	INC S + 1		
1360 29AF C5 58	:LL24 CMP #58	IF SEARCH POINTER < LIST POINTER THE PRECEEDING LINE IS NOT FOUND YET	
1370 29B1 A5 81	LDA S + 1		
1380 29B3 E5 59	SBC #59		
1390 29B5 90 DA	BCC LL22		
1400 29B7 A0 02	LDY @2		
1410 29B9 A9 0D	LDA @ #D		
1420 29BB C8	:LL25 INY	DETERMINE LENGTH OF LAST PRINTED LINE	
1430 29BC D1 80	CMP (S),Y		
1440 29BE D0 FB	BNE LL25		
1450 29C0 98	TYA		
1460 29C1 AA	TAX		
1470 29C2 E0 3E	CPX @62	AND ADJUST CURSOR POSITION IF IT IS LONGER THAN 1 VDU-LINE	
1480 29C4 90 03	BCC LL26		
1490 29C6 20 D3 29	JSR LL30		
1500 29C9 E0 1E	:LL26 CPX @30		
1510 29CB 90 03	BCC LL27		
1520 29CD 20 D3 29	JSR LL30		
1530 29D0 A6 85	:LL27 LDX T + 3	GET LENGTH OF LINE NOW TO BE PRINTED	
1540 29D2 60	RTS		
1600 29D3	\		
1610 29D3	\		
1620 29D3	\		
1630 29D3 A0 00	:LL30 LDY @0		
1640 29D5 B1 DE	LDA (#DE),Y	REMOVE CURSOR FROM SCREEN	
1650 29D7 45 E1	EOR #E1		
1660 29D9 91 DE	STA (#DE),Y		
1670 29DB A5 DE	LDA #DE		
1680 29DD 38	SEC		
1690 29DE E9 20	SBC @ #20	MOVE CURSOR 32 POSITIONS DOWN = 1 LINE UP	
1700 29E0 85 DE	STA #DE		
1710 29E2 B0 0E	BCS LL32		
1720 29E4 A5 DF	LDA #DF	CHECK IF WE MOVED THE CURSOR OFF THE SCREEN	
1730 29E6 C9 81	CMP @ #81		
1740 29E8 B0 06	BCS LL31		
1750 29EA 20 F9 29	JSR LL35	YES, SCROLL THE SCREEN DOWNWARDS BY 1 LINE	
1760 29ED C8	INY		
1770 29EE F0 02	BEQ LL32	UNCONDITIONAL BRANCH	
1780 29F0 C6 DF	:LL31 DEC #DF	MOVE CURSOR TO TOP HALF OF SCREEN	
1790 29F2 B1 DE	:LL32 LDA (#DE),Y		
1800 29F4 45 E1	EOR #E1	PRINT CURSOR ON SCREEN	
1810 29F6 91 DE	STA (#DE),Y		
1820 29F8 60	RTS		
1830 29F9	\		
1840 29F9	\	***SCROLL SCREEN DOWNWARDS BY 1 LINE*****	
1850 29F9	\		
1860 29F9 20 66 FE	:LL35 JSR #FE66	WAIT FOR FLYBACK PULSE	
1870 29FC A0 FF	LDY @ #FF		
1880 29FE B9 00 81	:LL36 LDA #8100,Y	MOVE BOTTOM HALF	
1890 2A01 99 20 81	STA #8120,Y		
1900 2A04 88	DEY		
1910 2A05 C0 FF	CPY @ #FF		
1920 2A07 D0 F5	BNE LL36		
1930 2A09 20 66 FE	JSR #FE66	WAIT FOR FLYBACK PULSE	
1940 2A0C B9 00 80	:LL37 LDA #8000,Y	MOVE TOP HALF	
1950 2A0F 99 20 80	STA #8020,Y		
1960 2A12 88	DEY		
1970 2A13 C0 FF	CPY @ #FF		
1980 2A15 D0 F5	BNE LL37		
1990 2A17 A9 80	LDA @ #80	CURSOR TO HOME POSITION	
2000 2A19 85 DF	STA #DF		
2010 2A1B C8	INY		
2020 2A1C 84 DE	STY #DE		
2030 2A1E 84 E0	STY #E0		
2040 2A20 20 22 FE	JSR #FE22	ERASE TOP LINE	
2050 2A23 60	RTS		
2060 2A24	\		
2070 2A24	\	***PRINT LINE*****	
2080 2A24	\		
2090 2A24 A0 01	:LL40 LDY @1		
2100 2A26 B1 58	LDA (#58),Y	GET LINE NUMBER TO Z-PAGE AND READY FOR PRINTING IN DECIMAL	
2110 2A28 85 25	STA #25		
2120 2A2A C8	INY		
2130 2A2B B1 58	LDA (#58),Y		
2140 2A2D 85 16	STA #16		
2150 2A2F A9 05	LDA @5		
2160 2A31 8D 21 03	STA #0321	SET FIELD WIDTH TO 5 PRINT LINE NUMBER	
2170 2A34 20 89 C5	JSR #C589		
2180 2A37 A9 08	LDA @8		
2190 2A39 8D 21 03	STA #0321	RESTORE FIELD WIDTH TO NORMAL STEP OVER LINE NUMBER	
2200 2A3C A0 03	LDY @3		
2210 2A3E B1 58	:LL41 LDA (#58),Y	GET CHARACTER IS IT A CR, END OF LINE?	
2220 2A40 C9 0D	CMP @ #D		
2230 2A42 F0 06	BEQ LL42		
2240 2A44 20 4C CA	JSR #CA4C	PRINT CHARACTER	
2250 2A47 C8	INY		
2260 2A48 D0 F4	BNE LL41		
2270 2A4A 84 80	:LL42 STY #80	SAVE LINE LENGTH	
2280 2A4C 60	RTS		

HINTS ON CONVERSION

This particular program has been written specifically for the Acorn ATOM computer and in machine code at that. Conversion to any other micro would inevitably require a sound knowledge of code programming. For this reason, we would not recommend that users of other machines attempt to adapt this routine to their own computer.

The Acorn ATOM is 'weird' in many ways, especially its particular version of BASIC, which was not written for home usage, but is extremely powerful in its own right. *Personal Computing* is currently working on a feature — which we hope to publish shortly — that will allow users of the ATOM to simply convert programs to run on their machines, and vice versa.

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Cash Sales	Bank Account
Credit Purchases	Year to Date Summary
Purchases — other	

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Let all those computer widows have a bash! The wives will really enjoy the fun of this program designed to keep all her recipes. Will even suggest a menu for a day/week! Excellent value.

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LISTING SOFTWARE

Looking for a program to buy? Look no further! If it's available, it's listed here in our exclusive and comprehensive software checklists.

Looking through any computer magazine can be a bewildering experience if you're in search of a program. Count the hundreds of ads and thousands of titles on sale and it would be easy to lose heart!

We've tried to sort out the confusion, and the sheer numbers, to present an easily understood list for each machine. Where possible, we have eliminated duplications, so that the same tape with a different label is not listed twice. Rather it should be credited once, with as many suppliers as we could find.

Table Codes

In order to fit as many programs as possible into our pages, we have had to use codes for some columns, considerably shortening the wording.

The information given for each program is: Title, memory required

to run it, company producing it, whether tape/cartridge or disk, type and supplier and price.

The codes we have used are:

Program Type

GM = Game
BS = Business routine
UT = Utility (ie. programming aid)
DO = Domestic
ED = Educational

How Sold

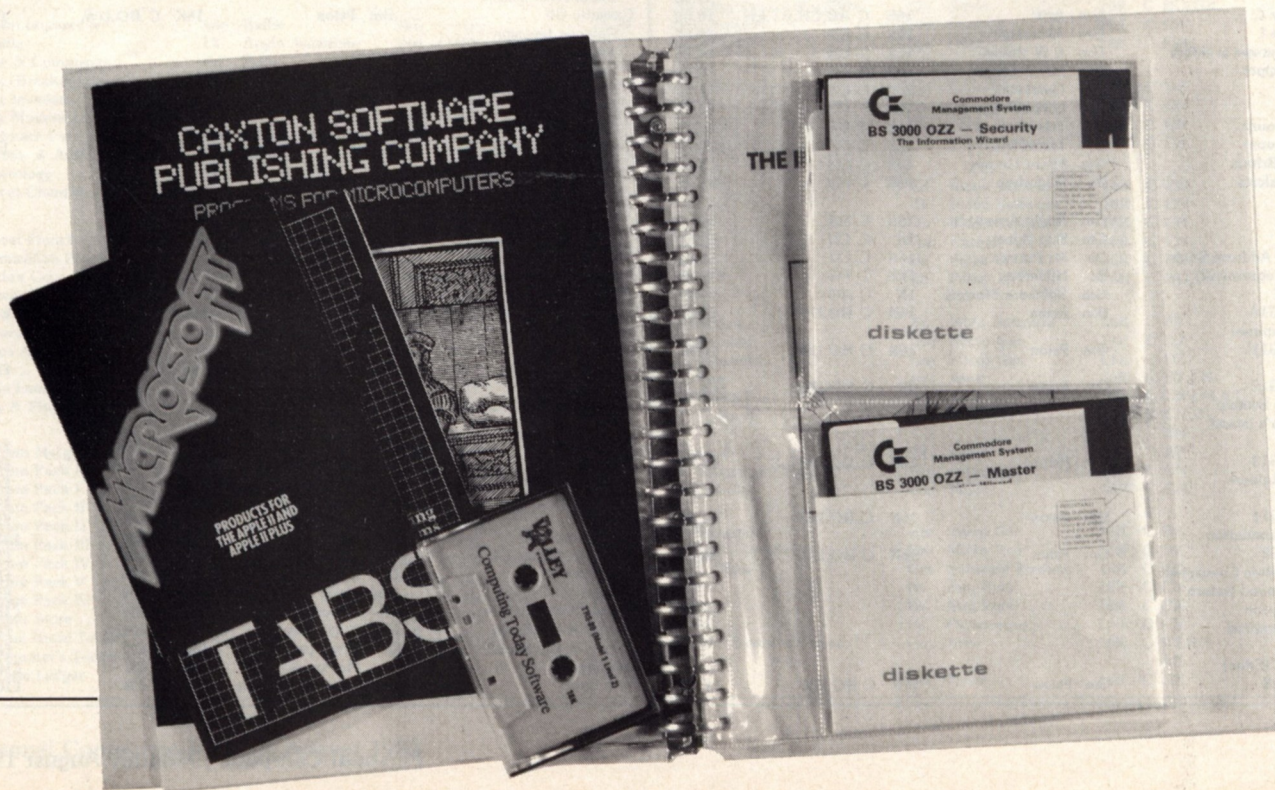
R = Cartridge (may include memory)
C = Tape (cassette)
D = Disc (for expanded systems)
L = Listing (sold as print-out)

These tables are repeated throughout the listings to save you having to

turn back and forth repeatedly. Once you've found the program you want, check the supplier code with the list of companies at the end of the article for address and telephone number.

Not Here?

To companies whose products are not listed herein we can only say TELL US ABOUT IT! This applies particularly to the smaller retailer who may sell only half a dozen or so programs for one machine. If you produce software for any of the machines on the market today, then we would love to include your wares in our checklists. Send it in to us, marked for the attention of the Editor (in our format *Please!*) or ring Chris Palmer on 01-437 1002 as soon as possible.



REFERENCE

SOFTWARE LISTING



ZX81

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes & Prices
1K Chess	Gm	Artic	1K	C EH	£2.95
1K Games Pack	Gm	Artic	1K	C BT,EH	£6.00
1K Maths	Ed	Mr Purves	1K	C CV	£3.50
1K Super Trio	Gm	Software Masters	1K	C AO	£7.95
16K Maths	Ed	Mr Purves	16K	C CV	£3.50
3-D Labyrinth	Gm	dK'tronics	16K	C EE	£3.95
3-D Monster Maze	Gm	J K Greye	16K	C CN	£4.95
Adventure	Gm	Anglo American	16K	C GB	£6.00
Adventure A	Gm	Artic	16K	C EH,BT,CN	£6.00
Adventure B	Gm	Artic	16K	C EH,BT,CN	£7.00
Adventure C	Gm	Artic	16K	C AB,CH,BT,EH	£8.00
Adventure I	Gm	Abbersoft	16K	C CN	£9.95
Around Europe in 80hrs	Gm	S W Hessel	16K	C CN	£4.25
Asset Stripper	Gm	Micro Games	16K	C CN	£4.50
Asteroids	Gm	Quicksilver	16K	C CN	£5.50
Bagatelle	Gm	Cambell Systems	1K	C CN	£4.00
Bank Account	Bs	Transform	16K	C GZ	£8.75
Bank Account	Bs	Transform	32K	C GZ	£10.75
Battle of Britain	Gm	Micro Games	16K	C CN	£4.50
Beam Analysis	Bs	Hilderbay	16K	C FW	£25.00
Breakout	Gm	Anglo American	16K	C GB	£4.50
Breakout	Gm	Bug Byte	1K	C CN	£3.50
Budget & Address Book	Do	Mr Purves	16K	C CV	£4.00
Budget Programs (2)	Bs	Hilderbay	16K	C FW	£17.00
Bumper 7	Gm	Software Masters	1K	C AO	£4.95
Cassette G10	Gm	Psion	16K	C BO,DW	£5.95
Backgammon	Gm	Psion	16K	C BO,DW	£6.95
Cassette G11	Gm	Psion	16K	C BO,DW	£6.95
Chess	Gm	Psion	8K	C BO,DW	£4.75
Cassette G12	Gm	Psion	8K	C BO,DW	£4.75
Perilous Swamp	Gm	Psion	16K	C BO,DW	£3.95
Sorcerer's Island	Gm	Psion	16K	C BO,DW	£3.95
Cassette G13	Gm	Psion	16K	C BO,DW	£3.95
Space Raiders	Gm	Psion	16K	C BO,DW	£5.95
Bomber	Gm	Psion	16K	C BO,DW	£5.95
Cassette G14	Gm	Psion	16K	C BO,DW	£5.95
Flight Simulation	Gm	Psion	16K	C BO,DW	£4.95
Cassette G2	Gm	Psion	16K	C BO,DW	£4.95
Feet/Metres Conversion	Gm	Psion	16K	C BO,DW	£4.95
Rings Round Saturn	Gm	Psion	16K	C BO,DW	£4.95
Secret Code	Gm	Psion	16K	C BO,DW	£4.95
Mind Boggling	Gm	Psion	16K	C BO,DW	£4.95
Silvete	Gm	Psion	16K	C BO,DW	£4.95
Memory (Educ)	Gm	Psion	16K	C BO,DW	£4.95
Cassette G3	Gm	Psion	16K	C BO,DW	£4.95
Train Race	Gm	Psion	16K	C BO,DW	£4.95
Challenge	Gm	Psion	16K	C BO,DW	£4.95
Secret Message	Gm	Psion	16K	C BO,DW	£4.95
Mind That Meteor	Gm	Psion	16K	C BO,DW	£4.95
Character Doodle	Gm	Psion	16K	C BO,DW	£4.95
Currency Conversion	Gm	Psion	16K	C BO,DW	£4.95
Cassette G4	Gm	Psion	16K	C BO,DW	£4.95
Down Under	Gm	Psion	16K	C BO,DW	£4.95
Submarines	Gm	Psion	16K	C BO,DW	£4.95
Doodling With Graphics	Gm	Psion	16K	C BO,DW	£4.95
Invisible Invader	Gm	Psion	16K	C BO,DW	£4.95
Reaction	Gm	Psion	16K	C BO,DW	£4.95
Petrol Conversion	Gm	Psion	16K	C BO,DW	£4.95
Cassette G5	Gm	Psion	16K	C BO,DW	£4.95
Martian Knockout	Gm	Psion	16K	C BO,DW	£4.95
Graffiti	Gm	Psion	16K	C BO,DW	£4.95
Find the Mate	Gm	Psion	16K	C BO,DW	£4.95
Labyrinth	Gm	Psion	16K	C BO,DW	£4.95
Drop a Brick	Gm	Psion	16K	C BO,DW	£4.95
Continental (Educ)	Gm	Psion	16K	C BO,DW	£4.95
Cassette G6	Gm	Psion	16K	C BO,DW	£4.95
Galactic Invasion	Gm	Psion	16K	C BO,DW	£4.95
Journey into Danger	Gm	Psion	16K	C BO,DW	£4.95
Create	Gm	Psion	16K	C BO,DW	£4.95
Nine Hole Golf	Gm	Psion	16K	C BO,DW	£4.95
Solitaire	Gm	Psion	16K	C BO,DW	£4.95
Daylight Robbery	Gm	Psion	16K	C BO,DW	£4.95
Cassette G7	Gm	Psion	16K	C BO,DW	£4.95
Race Track	Gm	Psion	16K	C BO,DW	£4.95
Chase	Gm	Psion	16K	C BO,DW	£4.95
Nim	Gm	Psion	16K	C BO,DW	£4.95
Tower of Hanoi	Gm	Psion	16K	C BO,DW	£4.95
Docking the Spaceship	Gm	Psion	16K	C BO,DW	£4.95
Golf	Gm	Psion	16K	C BO,DW	£4.95
Fascinating Tower of Hanoi (problem)	Gm	Psion	16K	C BO,DW	£4.95
Cassette G8	Gm	Psion	16K	C BO,DW	£4.95
Tower Trail	Gm	Psion	16K	C BO,DW	£4.95
Blank	Gm	Psion	16K	C BO,DW	£4.95
Cassette G9	Gm	Psion	16K	C BO,DW	£4.95
Bio-Rhythms	Gm	Psion	16K	C BO,DW	£4.95
Your Bio-Rhythms	Gm	Psion	16K	C BO,DW	£4.95
Catacombs	Gm	J K Greye	16K	C CN	£4.95
Centipede	Gm	dK'tronics	16K	C EE,CN	£4.95
Centipede (Graphics)	Gm	dK'tronics	16K	C EE	£4.95
Champions Quiz	Ed	Rose Cassettes	16K	C CN	£4.50
Chess	Gm	Micro Gen	16K	C DZ	£6.50
Chess II Special	Gm	Artic	16K	C EH	£45.00
Computer Count ZX	Bs	Silicon Tricks	16K	C CN	£7.95
Constellation	Gm	Anglo American	16K	C GB	£8.00
Counter	Gm	Pizzel	16K	C CN	£5.50
Critical Path Analysis	Bs	Hilderbay	16K	C FW	£15.00
Damsel & the Beast	Gm	Anglo American	16K	C GB	£6.50
Damsel & the Beast	Gm	Bug Byte	16K	C CN	£6.50
Data Base	Bs	Mr Purves	16K	C CV	£10.00
Data Base	Ut	Cambell Systems	16K	C CN	£10.00

Death Isle	Gm	Buffer	16K	C	CN	£4.50	Purchase Ledger	Bs	Transform	32K	C	GZ	£10.75
Defender	Gm	Quicksilva	16K	C	CN	£5.50	QS Asteroids	Gm	Quicksilva	4K	C	GD	£5.50
Deflex	Gm	dK'tronics	16K	C	EE	£3.95	QS Defenders	Gm	Quicksilva	4K	C	GD	£5.50
Dictator	Gm	Anglo American	16K	C	GB	£9.00	QS Invaders	Gm	Quicksilva	8K	C	GD	£5.50
Dictator	Gm	Bug Byte	16K	C	CN	£9.00	Revamped Chess	Gm	Micro Gen	16K	C	DZ	£6.50
Diggles Kitchen	Do	Micro Computer					Revise Chemistry	Ed	Sci-Soft	16K	C	CN	£7.50
		SW	16K	C	HK	£4.99	Revise Maths	Ed	Sci-Soft	16K	C	CN	£5.50
Double Breakout	Gm	Beam Software	1K	C	BT	£6.00							
Dragon Maze/Life	Gm	Software Masters	16K	C	AO	£6.95	Revise Physics	Ed	Sci-Soft	16K	C	CN	£7.50
Fast Life	Gm	dK'tronics	16K	C	EE	£3.95	Sales Ledger	Bs	Transform	16K	C	GZ	£8.75
Financial Package	Bs	Hilderbay	16K	C	FW	£8.00	Sales Ledger	Bs	Transform	32K	C	GZ	£10.75
Football Manager	Bs	Addictive Games	16K	C	HG	£7.95	Scramble	Gm	Quicksilva	4K	C	GD	£5.50
					CN	£9.95	Screenkit I	Bs	Picturesque	16K	C	CN	£4.95
Forth Compiler	Ut	Artic	16K	C	EH	£35.00	Secret Valley	Gm	Newsoft	16K	C	CN	£6.50
GB Ltd	Gm	S W Hessel	16K	C	CN	£5.25							
GCE Maths	Ed	Rose Cassettes	16K	C	CN	£4.50	Secret of Tenworth						
Galaxian	Gm	Artic	16K	C	EH,BT	£6.50	Manor	Gm	Hilderbay	16K	C	AB	£14.95
					AB	£5.50	Shop Window	Bs	Cambell Systems	16K	C	CN	£7.00
Galaxy Warrior/Star	Gm	Artic	16K	C	EH,BT	£6.50	Sorcerer's Castle	Gm	Micro Gen	16K	C	DZ	£3.95
Trek					AB	£5.50	Space Intruders	Gm	Hewson	4K	C	DT	£5.95
Games Pack I	Gm	Silversoft	16K	C	CN	£4.95							
Geography	Ed	Psion	16K	C	BO,DW	£6.95							
Gold	Gm	Hilderbay	16K	C	CN,FW	£8.00	Space Invaders	Gm	Macronics	16K	C	CN	£4.95
Greedy Gulch	Gm	Phipps Associates	16K	C	HL	£5.00	Space Invaders	Gm	Macronics	1K	C	CN	£3.95
Gulp	Gm	Cambell Systems	16K	C	CN	£4.00	Space Invaders	Gm	dK'tronics	16K	C	EE	£4.95
Hedgehog & Co	Gm	Buffer	1K	C	CN	£3.00	Space Invaders/Planetoids	Gm	Software Masters	16K	C	AO	£6.95
High Res. Graphics	Gm	Macronics	16K	C	CN	£4.00	Space Trek	Gm	Beam Software	16K	C	BT	£8.00
History	Ed	Psion	16K	C	BO,DW	£6.95	Spellbound	Ed	Transform	16K	C	GZ	£3.75
							Spelling	Ed	Psion	16K	C	BO,DW	£6.95
House of Gnomes	Gm	Anglo American	16K	C	GB	£7.00	Star Quest	Gm	Pizzel	16K	C	CN	£5.50
Inheritance	Gm	S W Hessel	16K	C	CN	£4.25	Star Trek	Gm	Buffer	16K	C	CN	£4.50
Invaders	Gm	Anglo American	16K	C	GB	£4.00	Star Trek	Gm	Bug Byte	16K	C	CN	£5.00
Invaders	Gm	Bug Byte	16K	C	CN	£4.00							
Invaders	Gm	Quicksilva	16K	C	CN	£5.50	Star Trek	Gm	Macronics	16K	C	CN	£3.95
Inventions before 1850	Ed	Psion	16K	C	BO,DW	£6.95	Star Trek	Gm	Silversoft	16K	C	CN	£4.95
Junior English I	Ed	Rose Cassettes	16K	C	CN	£4.50	Sargon Chess	Gm	Hilderbay	16K	C	AB	£22.50
Junior English II	Ed	Rose Cassettes	16K	C	CN	£4.50	Statistics	Bs	Hewson	1K	C	DT	£3.75
Junior Maths I	Ed	Rose Cassettes	16K	C	CN	£4.50	Stock Control	Bs	Hilderbay	16K	C	AB,FW	£25.00
Junior Maths II	Ed	Rose Cassettes	16K	C	CN	£4.50	Super Breakout	Gm	Essential S/W	1K	C	CN	£6.00
Kingdom of Nam	Gm	Micro Games	16K	C	CN	£4.50	Super Invasion	Gm	Beam Software	1K	C	BT	£6.00
Knockout Whist	Gm	Anglo American	16K	C	GB	£4.00	Super Invasion	Gm	Essential S/W	1K	C	CN	£6.00
Labyrinth	Gm	Axis	16K	C	CN	£5.95	Super Program I						
Labyrinth	Gm	Software Masters	16K	C	AO	£5.95	Pints/Litres Conversion						
Language Dictionary	Ut	Hewson	16K	C	DT	£3.75	Invasion from Jupiter						
Life	Gm	Artic	2K	C	BT	£3.00	Skittles						
Line Renumber	Ut	Hewson	16K	C	DT	£4.95	Magic Square						
Love and Death	Gm	Automata	1K	C	CN	£5.00	Doodle						
Machine Code Monitor							Kim						
Disassembler	Ut	Micro Gen	16K	C	DZ	£3.95							
Magic Cube	Gm	Cambell Systems	16K	C	CN	£4.00	Liquid Capacity	Gm	Psion	16K	C	BO,DW	£4.95
Magic Mountain	Gm	Phipps Associates	16K	C	HL	£5.00	Super Wumpus	Gm	Silversoft	16K	C	CN	£4.95
Man Page	Gm	Newsoft	16K	C	CN	£4.00	Ten Exciting Games	Gm	Beam Software	1K	C	BT	£6.00
Master Maths IV	Ed	LCL	16K	C	CN	£5.00	Test Pack	Ed	Mr Purves	16K	C	CV	£7.50
Master Maths V	Ed	LCL	16K	C	CN	£5.00	The Bible	Gm	Automata	1K	C	CN	£5.00
Mathematics	Ed	Psion	16K	C	BO,DW	£6.95	The Collector's Pack	Do	Psion	16K	C	BO,DW	£9.95
Maths Pack	Ed	Artic	4K	C	BT	£11.00							
Matrix Planner	Bs	G Asher	16K	C	CN	£6.00							
Mazogs	Gm	Bug Byte	16K	C	CN	£9.00							
Mini Space Invaders	Gm	Hewson	1K	C	DT	£3.95							
Mission Impossible	Gm	Buffer	16K	C	CN	£4.50	The Fast One	Bs	Cambell Systems	16K	C	CN	£15.00
Multifile	Ut	Anglo American	16K	C	GB	£17.50	The Plug Record Recorder	Do	Psion	16K	C	BO,DW	£9.95
Music & Composers	Ed	Psion	16K	C	BO,DW	£6.95	Time Bandits	Gm	Newsoft	16K	C	CN	£4.50
Music/Breakout/Invaders	Gm	Macronics	1K	C	CN	£7.95	Time Ledger	Bs	Hilderbay	16K	C	FW	£15.00
Nasty Invaders	Gm	Giltrole	16K	C	DC	£4.95							
Nasty Mountain	Gm	Giltrole	16K	C	DC	£4.95	Very Nasty Mountain	Gm	Giltrole	16K	C	DC	£6.95
Nightmare Park	Gm	Software Masters	16K	C	AO	£6.95	Video Index	Bs	Video Software	16K	C	CN	£9.95
Novellists & Authors	Ed	Psion	16K	C	BO,DW	£6.95	Video-add	Bs	Video Software	16K	C	CN	£5.95
Numerology	Gm	Carnell	16K	C	CN	£4.50	Videograph	Ed	Video Software	16K	C	CN	£5.95
O Level Chemistry	Ed	Calpac	16K	C	CN	£4.95							
							Videomap	Ed	Video Software	16K	C	CN	£5.95
O Level French	Ed	Rose Cassettes	16K	C	CN	£4.50	Videoplan	Bs	Video Software	16K	C	CN	£5.95
Optimisation Package	Bs	Hilderbay	16K	C	FW	£20.00	Videoview	Do	Video Software	16K	C	CN	£5.95
Oracle's Cove	Gm	Doric	16K	C	CN	£6.95	Volcanic Dungeon	Gm	Carnell	16K	C	CN	£4.50
Passwords	Gm	Giltrole	16K	C	DC	£3.95	Vucalc	Bs	Psion	16K	C	BO,DW	£7.95
Payroll	Bs	Hilderbay	16K	C	AB,FW	£25.00	Vufile	Bs	Psion	16K	C	BO,DW	£7.95
Pharaoh's Tomb	Gm	Phipps Associates	16K	C	HL	£5.00							
Phipps Adventures I	Gm	Phipps Associates	16K	C	CN	£5.00	Wordpack	Ed	Wida Software	16K	C	FY	£19.00
Pilot	Gm	Hewson	16K	C	DT	£5.95	ZX Bomber	Gm	Micro Gen	16K	C	DZ	£3.95
Planet Lander	Gm	Hewson	1K	C	DT	£3.75	ZX Breakout	Gm	Micro Gen	16K	C	DZ	£3.95
Poets & Playwriters	Ed	Psion	16K	C	BO,DW	£6.95	ZX Bug	Gm	Artic	16K	C	BT,EH	£7.00
							ZX Chess I	Gm	Artic	16K	C	CN,EH,BT	£6.50
							ZX Chess II	Gm	Artic	16K	C	CN,BT	£13.00
Program Merge	Bs	ACS	16K	C	CN	£5.50							
Program Pack I	Gm	Bug Byte	1K	C	CN	£3.50	ZX Forth	Ut	Artic	16K	C	AB	£35.00
Program Pack I	Ut	Anglo American	16K	C	GB	£3.50	ZX Graphical Chess	Gm	Artic	16K	C	CN	£13.00
Program Pack II	Gm	Bug Byte	16K	C	CN	£4.50	ZX Othello	Gm	MOI	16K	C	CN	£6.95
Program Pack II	Ut	Anglo American	16K	C	GB	£3.50							
Program Pack III	Gm	Bug Byte	1K	C	CN	£3.50	ZX Scramble	Gm	Micro Gen	16K	C	DZ	£3.95
Program Pack IV	Gm	Bug Byte	16K	C	CN	£4.50	ZX Space Invaders	Gm	Micro Gen	16K	C	DZ	£3.95
Program Pack V	Gm	Bug Byte	16K	C	CN	£4.50	ZX81 Chess	Gm	Software Masters	16K	C	AO	£6.90
Program Pack IV	Gm	Bug Byte	16K	C	CN	£4.50	ZKAS	Bs	Bug Byte	16K	C	CN	£5.00
Program Store	Bs	ACS	16K	C	CN	£5.50	ZXDB	Bs	Bug Byte	16K	C	CN	£6.50
Program Store Toolkit	Bs	ACS	16K	C	CN	£5.50	ZXMC	Bs	Picturesque	16K	C	CN	£6.50
Programmer's Toolkit	Ut	Hewson	16K	C	DT	£6.50	Zombie/Sword of Peace	Gm	Artic	16K	C	BT,EH	£6.50
Purchase Ledger	Bs	Transform	16K	C	GZ	£8.75							
							Zor	Gm	Pizzel	16K	C	CN	£5.50

REFERENCE

SOFTWARE LISTING

TEXAS

A-Maz-Ing	Gm Texas	8K	R AB,CH	£24.00
Addition, Subtraction I	Ed Texas	8K	R AB	£35.00
Addition, Subtraction II	Ed Texas	8K	R AB	£35.00
Attack	Gm Texas	8K	R AB	£30.00
Beginning Grammar	Ed Texas	8K	R AB	£20.00
Blackjack Poker	Gm Texas	8K	R AB	£24.00
Blasto	Gm Texas	8K	R AB	£25.00
Car Wars	Gm Texas	8K	R AB,CH	£25.00
Chequebook Manager	Bs Texas Max	16K	D AB	£19.00
Connect 4	Gm Texas	8K	R AB	£24.00
Eagly Reading	Ed Texas	8K	R AB	£35.00
Editor Assembler	Ut Texas	8K	R AB	£115.00
Electrical Eng'g Library	Bs Texas Max	16K	C AB	£24.00
Electrical Eng'g Library	Bs Texas Max	16K	D AB	£35.00
Extended Basic	Ut Texas	8K	R AB	£100.00
Graphing Package	Do Texas Max	16K	C AB	£14.00
Graphing Package	Do Texas Max	16K	D AB	£19.00
Hangman	Gm Texas	8K	R AB	£24.00
Household Money Management	Do Texas	8K	R AB	£25.00
Hunt The Wumpus	Gm Texas	8K	R AB,CH	£25.00
Hustle	Gm Texas	8K	R AB	£30.00
Mailing List	Bs Texas Max	16K	D AB	£60.00
Market Simulation	Bs Texas	32K	C AB	£9.00
Market Simulation	Bs Texas	32K	D AB	£19.00
Maths Routine Library	Ed Texas Max	16K	C AB	£24.00
Maths Routine Library	Ed Texas Max	16K	D AB	£35.00
Mind Challenges	Gm Texas	16K	R CH	£24.95
Multiplication	Ed Texas	8K	R AB	£35.00
Music Makers	Do Texas	8K	R AB	£35.00
Music Maker	Ed Texas	16K	D AB	£14.00
Music Skills Trainer	Ed Texas Max	16K	C AB	£19.00

Music Skills Trainer	Ed Texas Max	16K	D AB	£24.00
Number Magic	Ed Texas	8K	R AB	£18.00
Oldies but Goodies	Gm Texas Max	16K	C AB	£9.00
Oldies but Goodies	Gm Texas Max	16K	D AB	£14.00
Othello	Gm Texas	8K	R AB	£40.00
Personal Record Keeping	Do Texas	8K	R AB	£50.00
Personal Report Generator	Do Texas	8K	R AB	£70.00
Physical Fitness	Do Texas	8K	R AB	£20.00
Pre-School Learning Fun	Ed Texas	8K	R AB	£17.00
Programming Aids I	Ut Texas	16K	C AB	£9.00
Programming Aids I	Ut Texas	16K	D AB	£14.00
Programming Aids II	Ut Texas	16K	D AB	£24.00
Programming Aids III	Ut Texas	16K	D AB	£19.00
Saturday Night Bingo	Gm Texas Max	16K	C AB	£14.00
Soccer	Gm Texas	8K	R AB,CH	£30.00
Speech Editor	Gm Texas	8K	R AB	£35.00
Statistics	Do Texas	8K	R AB	£45.00
Structural Eng'g Library	Bs Texas	16	C AB	£24.00
Structural Eng'g Library	Bs Texas Max	16K	D AB	£35.00
TI Invaders	Gm Texas	8K	R AB,CH	£40.00
TI Trek	Gm Texas Max	16K	D AB	£14.00
Teach Yourself Extended Basic	Ed Texas	32K	C AB	£20.00
Teach Yourself Extended Basic	Ed Texas	32K	D AB	£29.00
Teach Yourself Basic	Ed Texas	32K	C AB	£30.00
Teach Yourself Basic	Ed Texas	32K	D AB	£40.00
Terminal Emulator	Ut Texas	8K	R AB	£57.00
Tombstone City	Gm Texas	8K	R AB,CH	£40.00
Tunnels of Doom	Gm Texas	8K	R AB,CH	£40.00
US Football	Gm Texas	8K	R AB	£24.00
Video Chess	Gm Texas	8K	R AB,CH	£50.00
Video Games I	Gm Texas	8K	R AB,CH	£25.00
Video Games II	Gm Texas	8K	R AB	£25.00
Yahtzee	Gm Texas	8K	R AB	£30.00
Zero Zap	Gm Texas	8K	R AB	£24.00



BBC

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes & Prices
Algebraic Manipulation	Ut	Acornsoft	16K	C AL,GA	£9.95
Characters	Ut	Computer Concepts	16K	C GJ	£6.67
Code Race	Gm	Computer Concepts	16K	C GJ	£6.67
Creative Graphic Pack	Ut	Acornsoft	16K	C AL,GA	£9.95
Desk Diary	Bs	Acornsoft	16K	C AL	£9.95
Early Warning	Gm	A&F Software	16K	C GE	£6.00
Graph and Charts Pack	Bs	Acornsoft	16K	C AL,GA	£9.95
Lisp	Bs	Acornsoft	16K	C AL,GA	£16.85
Minefield	Gm	A&F Software	16K	C GE	£6.00
Multifile	Bs	Bug Byte	16K	C EA	£25.00
Othello	Gm	Computer Concepts	16K	C GJ	£8.95
Peeko Computer	Bs	Acornsoft	16K	C AL,GA	£9.95
Polecat	Gm	A&F Software	16K	C GE	£6.00
Lisp	Ut	Acornsoft	32K	C AL,GA	£16.85
Monsters	Gm	Acornsoft	32K	C AL,GA	£9.95
Othello	Gm	Computer Concepts	32K	C GJ	£8.95
Peeko Computer	Ut	Acornsoft	32K	C AL,GA	£9.95
Philosopher's quest	Gm	Acornsoft	32K	C AL,GA	£9.95
Snake	Gm	Computer Concepts	32K	C GJ	£6.67
Snapper	Gm	Acornsoft	32K	C AL,GA	£9.95
Space Warp	Gm	Bug Byte	32K	C GA,EA	£11.50
Teacher's Toolkit	Ed	Wida Software	32K	C FY	£30.00
Wordwise	Gm	Computer Concepts	32K	C GJ	£74.75
Valley, The	Gm	CT Software	32K	C PF	£9.95
Algebraic Manipulation	Ut	Acornsoft	32K	C AL,GA	£9.95
Backgammon	Ut	Bug Byte	32K	C EA	£8.00
Characters	Ut	Computen Concepts	32K	C GJ	£6.67

Chess	Gm	Bug Byte	32K	C EA	£11.50
Code Race	Ut	Computer Concepts	32K	C GJ	£6.67
Creative Graphics	Ut	Acornsoft	32K	C AL,GA	£9.95
Defender	Gm	Acornsoft	32K	C AL,GA	£9.95
Desk Diary	Bs	Acornsoft	32K	C AL,GA	£9.95
FORTH	Ut	Acornsoft	32K	C AL	£16.85
Golf	Gm	Bug Byte	32K	C GA,EA	£7.00
Graph and Charts Pack	Bs	Acornsoft	32K	C AL,GA	£9.95



TRS 80

A-Maz-Ing	Gm	Molimerx	4K	C AJ	£6.33
Adventure I	Gm	Adventure Int.	16K	AJ	£13.77
Adventure III	Gm	Adventure Int.	16K	C AJ	£13.77
Adventure III	Gm	Adventure Int.	16K	D AJ	£13.77
Adventureland	Gm	Adventure Int.	24K	D AB	£18.99
Adventure Mysterious	Gm	Adventure Int.	16K	C AJ	£10.06
Adventure Mysterious	Gm	Adventure Int.	32K	D AJ	£13.50
Airflight Simulation	Gm	Instant S/W	16K	C GB,AB	£9.95
Airmail Pilot	Gm	Instant S/W	16K	C GB,AB	£8.50
Ajedit	Bs	Molimerx	32K	C AJ	£49.95
Alien Armada	Gm	Molimerx	16K	C AJ	£10.06
Alien Armada	Gm	Molimerx	32K	D AJ	£13.23
Alien Attack Force	Gm	Instant S/W	16K	C GB,AB	£8.50
Alien Defence	Gm	Soft Sector Mkting		C GB	£15.50
Alien Defence	Gm	Soft Sector Mkting		D GB	£19.75
All Stars	Gm	Instant S/W		D GB	£26.50
				AB	£28.95
All Turret Gunner	Gm	Instant S/W		C GB,AB	£8.50
Amateur Log	Ut	Molimerx	32K	D AJ	£18.40
Angel Worms	Gm	Adventure Int.	8K	C AB	£14.35
Animation	Ut	Molimerx	16K	C AJ	£17.20
Animation	Ut	Molimerx	32K	D AJ	£20.65
Android Nim	Gm	Molimerx	16K	C AJ	£10.06
Armoured Patrol	Gm	Adventure Int.	16K	C GB	£15.50
Armoured Patrol	Gm	Adventure Int.	16K	D AB	£18.99
Assembly Package	Ut	Molimerx	32K	D AJ	£74.75
Asteroids	Gm	Molimerx	16K	C AJ	£10.06
Asteroids	Gm	Molimerx	32K	D AJ	£13.50
Astro Navigator	Gm	Molimerx	16K	C AJ	£14.95
Astroball	Gm	Molimerx	16K	C AJ	£13.77
Astrolog	Ed	Molimerx	16K	C AJ	£10.93
Astronomical Calendar	Ed	Molimerx	16K	C AJ	£10.93
Asylum	Gm	Med Systems		C BT	£12.00
Atlantian Odyssey	Gm	Guild		C GB	£19.75
Atlantian Odyssey	Gm	Guild		D GB	£21.50
Attack Force	Gm	Big 5 S/W	16K	C GB,BT	£10.95
BI Nuclear Bomber	Gm	Instant S/W	16K	C GB	£12.50
				BT	£12.95
BQ81	Bs	Baust Computing	48K	D HA	£79.95
Back 40	Gm	Molimerx	16K	C AJ	£10.06
Back 40	Gm	Molimerx	32K	D AJ	£13.50
Back 40 III	Gm	Adventure Int.	16K	C AB	£14.35
Backgammon	Gm	Adventure Int.	16K	C AB	£7.99
Balrog Sampler	Gm	Adventure Int.	16K	D AB	£33.70
Bandito	Gm	Acorn	16K	C AJ	£7.49
Basic Compiler Accel.	Ut	Microsoft	16K	C AJ	£22.94
Basic Compiler Accel. 3	Ut	Microsoft	16K	C AJ	£45.95
Basic Compiler Accel. 3	Ut	Microsoft	16K	D AJ	£49.95

Basic Insert	Ut	Molimerx	16K	C AJ	£10.95
Basic Insert	Ut	Molimerx	32K	D AJ	£14.39
Basic Programming System	Ut	Instant S/W	16K	C AB	£12.50
Basketball	Gm	Molimerx	16K	C AJ	£10.95
Basketball	Gm	Molimerx	32K	D AJ	£14.39
Battle of Britain	Gm	Molimerx	16K	C AJ	£15.55
Battle Ground	Gm	Instant S/W	16K	C GB,AB	£8.50
Bedchest III	Gm	Adventure Int.	16K	C AB	£20.95
Beewary	Gm	Molimerx	16K	C AJ	£10.06
Beginner's Russian	Ed	Instant S/W	16K	C GB,AB	£8.50

Biorhythm	Ed	Molimerx	16K	C AJ	£8.63
Blackboard	Ut	Molimerx	16K	C AJ	£10.06
Blackjack Master	Gm	Molimerx	16K	C AJ	£21.15
Blackjack Master	Gm	Molimerx	32K	D AJ	£25.42
Blink 1	Ut	Molimerx	32K	D AJ	£17.00
Blockade	Gm	Molimerx	16K	C AJ	£7.48
Bright & Early	Ed	Molimerx	16K	C AJ	£8.90



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SOFTWARE LISTING

Business Analysis	Bs	Instant S/W	16K	C GB	£59.25	Dark Void	Gm	Molimerx	16K	C AJ	£10.06
Business Analysis	Bs	Instant S/W	16K	D GB,AB	£82.00	Darts	Gm	Molimerx	16K	C AJ	£10.06
Buzzword	Ed	Molimerx	16K	C AJ	£5.75	Data Base Management	Bs	Hubert Howe	32K	C AJ	£28.75
CTN Stock	Bs	Baust Computing	48K	D HA	£79.00	Data Base Management	Bs	Hubert Howe	32K	D AJ	£32.20
Calendar	Ut	Molimerx	16K	C AJ	£10.29	Datestone of Ryn	Gm	Automated Simulation	16K	C GB	£13.50
Cash Register	Bs	Molimerx	16K	C AJ	£10.29						
Checker King	Gm	Personal S/W	16K	C AJ	£16.10	Datestone of Ryn	Gm	Automated Simulation	16K	D GB	£15.50
Chemical Formulae	Ed	Molimerx	16K	C AJ	£10.95	Day of the Week	Bs	Molimerx	4K	C AJ	£5.75
Cheque Book	Dm	Molimerx	16K	C AJ	£15.53	Decision Master	Ut	Sytonic S/W	32K	D GB	£35.50
City Encounters	Ut	Molimerx	16K	C AJ	£17.20	Defence Command	Gm	Big 5 S/W	16K	C GB,BT	£10.95
Climate Comp	Bs	Instant S/W	16K	AB	£20.50	Defend	Gm	Molimerx	16K	C AJ,CH	£14.95
Code Breaker	Gm	Molimerx	16K	C AJ	£7.49	Defend	Gm	Molimerx	32K	D AJ	£18.40
Combat	Gm	Adventure Int.	16K	C AB	£12.50	Deflections	Gm	Adventure Int.	8K	C AB	£14.35
Company Director	Gm	Molimerx	16K	C AJ	£17.19	Descriptive Statistics	Bs	Molimerx	16K	C AJ	£15.40
Compression Utility	Ut	Instant S/W	16K	C GB	£15.75	Differential Equations	Bs	Molimerx	16K	C AJ	£16.10
				AB	£16.50	Direction Finder	Ed	Molimerx	16K	C AJ	£15.40
Comproc	Ut	Molimerx	16K	C AJ	£15.80	Disassembler	Ut	Molimerx	16K	C AJ	£10.35
Comput-A-Organ	Ed	Molimerx	16K	C AJ	£6.85	Disassembler	Ut	Buy Byte	16K	C GB	£8.25
Computer Acquire	Gm	Adventure Int.	16K	C AB	£10.15					AB	£8.50
Computer Acquire	Gm	Avalon Hill	16K	C GB	£17.25	Disc Directory	Ut	Molimerx	32K	D AJ	£20.13
Computer Pools	Do	Molimerx	16K	C AJ	£16.68	Disc Editor	Ut	Instant S/W	16K	D GB	£30.50
Conflict 2500	Gm	Avalon Hill	16K	C BT	£12.95	Disc Scope	Ut	Instant S/W	16K	D GB	£15.50
Conquest of Chester Wood	Gm	Adventure Int.	16K	C AB	£18.99	Discaid	Ut	Molimerx	32K	D AJ	£19.49
Constellation	Ed	Molimerx	16K	C AJ	£14.30	Discator	Ut	Molimerx	32K	D AJ	£29.90
Constellation	Ed	Molimerx	32K	D AJ	£17.83	Dnieper River Line	Gm	Avalon Hill	32K	C BH	£12.95
Conv/CPM	Ut	Molimerx	32K	D AJ	£20.70	Dnieper River Line	Gm	Avalon Hill	32K	D BH	£17.55
Convoy Raider	Gm	Avalon Hill		C BT	£10.95	Doctor Chips	Gm	Instant S/W	16K	C GB	£12.50
Cop 16K	Ut	Molimerx	16K	C AJ	£12.95	Doctor Chips	Gm	Instant S/W	16K	D GB	£14.75
Copsys	Ut	Molimerx	16K	C AJ	£12.95	Dominoes	Gm	Molimerx	16K	C AJ	£9.15
Corplan	Gm	Molimerx	16K	C AJ	£32.79	Dominoes	Gm	Molimerx	32K	D AJ	£12.65
Cosmic Fighter	Gm	Big 5 S/W		C GB,BT	£10.95	Dosort	Ut	Molimerx	32K	C AJ	£27.60
Cosmic Patrol	Gm	Instant S/W	16K	C GB,AB	£12.50	Double Take 3741	Ut	Molimerx	64K	D AJ	£44.85
Cosmic Patrol	Gm	Instant S/W	16K	D GB,AB	£16.25	Dragon Quest	Gm	Instant S/W	16K	C GB	£13.25
Creole Lobster Catcher	Gm	Molimerx	16K	C AJ	£10.06	Dragon Quest	Gm	Instant S/W	16K	D GB	£17.50
Cribbage	Gm	Molimerx	16K	C AJ	£14.38	Dragons of Hong Kong	Gm	Adventure Int.	32K	C AB	£18.99
Cross Reference	Bs	Molimerx	16K	C AJ	£8.45	Draughts	Gm	Molimerx	16K	C AJ	£14.95
Cube Hunt	Gm	Molimerx	16K	C AJ	£10.35	Draughts	Gm	Molimerx	32K	D AJ	£18.40
Curse of Crawley Manor	Gm	Adventure Int.	16K	D AB	£18.99	Draw and Graphics Resolver	Bs	Molimerx	16K	C AJ	£10.95
DLDIS	Ut	Instant S/W	16K	D GB	£15.50	Dreamworld	Gm	Molimerx	16K	C AJ	£10.06
				AB	£16.50	Driver	Gm	Molimerx	4K	C AJ	£6.33
DSM	Ut	Racet Computers	32K	D AJ	£46.00	Duel-n-Droids	Gm	Molimerx	16K	C AJ	£10.93
Danger in Orbit	Gm	Instant S/W	16K	C AB	£12.50	Dungeon Escape	Gm	Computer Shack	16K	C GB	£11.95
Danger in Orbit	Gm	Instant S/W	16K	D GB	£15.50	Dungeon Escape	Gm	Computer Shack	16K	D GB	£15.50



Dynamic Device Driving	Ut	Instant S/W	16K	D GB	£20.50	Jet Fighter Pilot	Gm	Instant S/W	16K	C GB,AD	£12.50
Dynamic Device Driving	Ut	Instant S/W	16K	C GB	£15.50	Kid's Gallery	Gm	Instant S/W	16K	C AB	£8.50
				AB	£16.50	Label	Gm	Instant S/W	16K	C GB	£18.75
										AB	£20.50
Edas	Ut	Molimerx	32K	D AJ	£53.49	Labyrinth	Gm	Med Systems	16K	C GB	£11.75
Edit	Ut	Molimerx	16K	C AJ	£20.13					BT	£10.95
Editor Assembler Plus	Ut	Molimerx	16K	C AJ	£24.95						
Edjust	Ut	Molimerx	32K	D AJ	£18.40	Laser Defence	Gm	Med Systems	16K	C GB	£11.95
Electric Accountant	Bs	Molimerx	48K	D AJ	£28.75	Laser Defence	Gm	Med Systems	16K	D GB	£14.50
Electronic Breadboard	Ut	Instant S/W	16K	C GB	£39.75	Little Red Riding Hood	Gm	Adventure Int.	16K	C AB	£14.35
				AB	£40.95	Local Call for Death	Gm	Adventure Int.	32K	D AB	£18.99
Elemental Maze	Ed	Molimerx	16K	C AJ	£10.93	Lords of Karma	Gm	Avalon Hill	40K	D BH	£14.95
Eliminator	Gm	Adventure Int.	16K	C GB	£15.50	Lunar Lander	Gm	Adventure Int.	16K	C AB	£12.50
Eliminator	Gm	Adventure Int.	16K	D AB	£18.99	Lunar Lander	Gm	Adventure Int.	16K	D AB	£18.99
Emperor	Gm	Molimerx	16K	C AJ	£15.53	Mail File	Ut	Instant S/W		D GB	£75.25
Empire of the Overmind	Gm	Avalon Hill	48K	C BT,BH	£17.95	Master Directory	Ut	Instant S/W	16K	D GB	£21.00
Enhanced Basic	Ut	Molimerx	16K	C AJ	£27.60	Master Reversi	Ut	Instant S/W	16K	D GB	£23.75
Enhanced Basic	Ut	Molimerx	32K	D AJ	£31.05	Matchmaker	Gm	Adventure Int.	16K	C AB	£14.35
Epson Patch	Ut	Molimerx	16K	C AJ	£13.80	Maths Master	Ed	Instant S/W	16K	C AB	£8.50
Epson Patch	Ut	Molimerx	32K	D AJ	£17.25	Maxi-Micro Manager	Bs	Adventure Int	48K	R AB	£84.50
Escape from Tramm	Gm	Adventure Int.	16K	D AB	£18.99	Meteor Mission	Gm	Big 5 S/W	16K	C GB,BT	£10.95
Everest Explorer	Gm	Molimerx	16K	C AJ	£10.06	Midway Campaign	Gm	Avalon Hill	16K	C BT	£10.95
Everest Explorer	Gm	Molimerx	32K	D AJ	£13.50	Minotaur	Gm	Instant S/W	16K	C AB	£8.50
Everyday Russian	Ed	Instant S/W	16K	C GB,AB	£8.50	Missile Attack	Gm	Adventure Int.	16K	C AB	£12.50
						Mission Impossible	Gm	Adventure Int.	24K	D AB	£18.99
Fairytale Adventure	Gm	Molimerx	16K	C AJ	£10.06	Monopolist	Gm	Baust Computing	4K	C HA	£7.95
Family Tree	Do	Molimerx	32K	D AJ	£20.70	Monopolist	Gm	Baust Computing	4K	D HA	£10.95
Farmer Brown	Gm	Molimerx	16K	C AJ	£7.49	Mountain Shoot	Gm	Adventure Int.	16K	D AB	£18.99
Fed	Ut	Molimerx	32K	D AJ	£27.60	Music Master	Gm	Instant S/W		C GB,AB	£8.50
Fetch	Ut	Molimerx	32K	D AJ	£15.53	Musical Yat-C	Gm	Adventure Int.	16K	C AB	£12.50
File Handling for Cassette	Ut	Molimerx	16K	C AJ	£15.93	Mystery Funhouse	Gm	Adventure Int.	24K	D AB	£18.99
File Handling for Disc	Ut	Molimerx	32K	D AJ	£28.75						
Filter Package	Ut	Molimerx	32K	D AJ	£40.25	News 80	Bs	Baust Computing	48K	D HA	POA
Financial Analysis	Bs	Molimerx	32K	D AJ	£46.00	Night Flight	Gm	Instant S/W	16K	C GB,AB	£8.50
Find it Quick	Ut	Instant S/W	16K	D GB	£39.75	Norton Forth	Gm	Adventure Int.	32K	D AB	£33.70
				AB	£40.95	Nuke War	Gm	Avalon Hill	16K	C BH	£10.95
Flight Path	Gm	Instant S/W	16K	C GB,AB	£8.50	Oil Tycoon	Gm	Instant S/W	16K	C AB	£8.50
Flight Plan	Ut	Molimerx	32K	D AJ	£20.70					GB	£9.95
Flying Circus	Gm	Instant S/W	16K	D AB	£24.50	Old McDonald's Farm	Gm	Adventure Int.	16K	C AB	£14.35
				GB	£25.00	Perfect Pong	Gm	Instant S/W	16K	C GB,AB	£12.75
Forbidden City	Gm	Fantastic S/W	16K	D GB	£27.75	Personal Bill Paying	Do	Instant S/W	16K	C AB	£6.50
Forest of Mordor	Gm	Molimerx	16K	C AJ	£8.63	Pirate Adventure	Gm	Adventure Int.	24K	D AB	£18.99
Fortran	Ut	Molimerx	32K	D AJ	£74.75	Planet Miners	Gm	Avalon Hill	16K	C BH	£10.95
Fortress	Gm	Soft Secto Mktingr	16K	D GB	£15.50	Planetoids	Gm	Adventure Int.	16K	C AB	£12.50
Fortress	Gm	Soft Sector Mkting	16K	C GB	£11.95	Programmer and Primer	Ut	Instant S/W	16K	C AB	£8.50
Fox and Hounds	Gm	Molimerx	16K	C AJ	£7.48	Programmer's Converter	Ut	Instant S/W	16K	C AB	£8.50
French Vocabulary	Ed	Molimerx	16K	C AJ	£17.19	Pyramids of Doom	Gm	Adventure Int.	24K	D AB	£18.99
Frog	Gm	Adventure Int.	16K	C AB	£12.50	QSL Manager	Do	Instant S/W	16K	AB	£16.50
Frog	Gm	Molimerx	16K	C AJ	£7.48	Quick Change	Bs	Baust Computing	16K	C HA	£9.95
Galactic Empire	Gm	Adventure Int.	16K	C AJ,AB	£9.78	Quick Change	Bs	Baust Computing	16K	D HA	£12.95
Galactic Empire	Gm	Adventure Int.	32K	D AB	£18.99	Renumer and Compress	Ut	Instant S/W	16K	C AB	£8.50
Galactic Revolution	Gm	Adventure Int.	16K	C AB	£18.99	SDM	Gm	Adventure Int.	16K	C AB	£20.12
Galactic Revolution	Gm	Adventure Int.	16K	C AJ	£9.78	Santaparavia	Gm	Instant S/W	16K	C AB	£8.50
Galactic Trader	Gm	Adventure Int.	16K	C AJ	£9.78	Savage Island I	Gm	Adventure Int.	24K	D AB	£18.99
Galactic Trader	Gm	Adventure Int.	32k	D AB	£18.99	Savage Island II	Gm	Adventure Int.	24K	D AB	£18.99
Galaxy Invasion	Gm	Big 5 S/W	16K	C GB,BT	£10.95	Showdown	Gm	Adventure Int.	16K	C AB	£12.50
Gammon Challenger	Gm	Molimerx	16K	C AJ	£10.06	Silverflash	Gm	Adventure Int.	16K	C AB	£12.50
Gammon Challenger	Gm	Molimerx	32K	D AJ	£13.51	Simutec	Gm	Adventure Int.	16K	C AB	£12.50
Gauntlet of Death	Gm	Programmer's Guild	16K	C GB	£15.50	Six Microstories	Gm	Adventure Int.	32K	D AB	£14.35
Gauntlet of Death	Gm	Programmer's Guild	16K	C GB	£15.50	Sky Warrior	Gm	Adventure Int.	16K	D AB	£18.99
Gencop	Ut	Molimerx	16K	C AJ	£10.06	Slag	Gm	Adventure Int.	16K	C AB	£14.35
Geography Explorer	Ed	Instant S/W	16K	AB	£40.95	Space Intruder	Gm	Adventure Int.	16K	C AB	£14.35
Ghost Town	Gm	Adventure Int.	24K	D AB	£18.99	Space Shuttle	Gm	Instant S/W	16K	C AB	£12.50
Golden Voyage	Gm	Adventure Int.	24K	D AB	£18.99	Star Fighter	Gm	Adventure Int.	16K	C AB	£20.95
Golf	Gm	Molimerx	32K	D AJ	£17.19	Star Scout	Gm	Adventure Int.	16K	C AB	£14.35
Guns of Fort Defiance	Gm	Avalon Hill	32K	C BH	£12.95	Star Trek 3.5	Gm	Adventure Int.	32K	D AB	£18.99
Guns of Fort Defiance	Gm	Avalon Hill	32K	D BH	£14.95	Stock or Bonds	Gm	Avalon Hill	16K	C BH	£12.95
HMS Impetuous	Gm	Adventure Int.	32K	D AB	£18.99	Stone of Sisythus	Gm	Adventure Int.	32K	D AB	£33.70
House of 30 Gables	Gm	Instant S/W	16K	C AB	£8.50	Strange Odyssey	Gm	Adventure Int.	24K	D AB	£18.99
Hyperlight Patrol	Gm	Fantastic S/W	16K	D GB	£11.25	Sunday Golf	Gm	Adventure Int.	16K	D AB	£18.99
ID Mailing List	Ut	Instant S/W	16K	D GB	£19.50	Surveyor's Apprentice	Ed	Instant S/W	16K	C AB	£8.50
				AB	£20.50	Swamp War	Gm	Instant S/W	16K	C AB	£12.50
IRV	Ut	Instant S/W	16K	D GB	£23.75	TL DIS	Ut	Instant S/W	16K	C AB	£12.50
IRV	Ut	Instant S/W	16K	C GB	£19.50	TRS Test	Ut	Instant S/W	16K	C AB	£8.50
Interlude				AB	£20.50	Tanktics	Gm	Avalon Hill	16K	C BH	£15.95
Interlude	Gm	Syntonic S/W		C GB	£20.25	Teacher's Aid	Ed	Instant S/W	16K	AB	£34.50
Invasion Orion	Gm	Syntonic S/W		D GB	£23.50	Temple of the Sun	Gm	Instant S/W	16K	AB	£16.50
Invasion Orion	Gm	AutomatedSim-ulation		C GB	£13.25	The Count	Gm	Adventure Int.	24K	D AB	£18.99
Invasion Orton	Gm	Automated Simulation		D GB	£15.75	The Mean Checkers Machine	Gm	Adventure Int.	16K	C AB	£14.35
Investor's Paradise	Gm	Instant S/W	16K	C AB	£8.50	Treasure Quest	Gm	Adventure Int.	16K	C AB	£14.35
Jabbertalky	Gm	Automated Simulation	16K	D GB	£18.95	Tunnels of Fahad	Gm	Adventure Int.	16K	C AB	£12.50
						Two Heads of the Coin	Gm	Adventure Int.	32K	D AB	£18.99
						Typing Teacher	Ed	Instant S/W	16K	C AB	£8.50
						Ultra Man	Ut	Instant S/W	16K	AB	£21.50
						Voodoo Castle	Gm	Adventure Int.	24K	D AB	£18.99
						Voyager	Gm	Avalon Hill	16K	C BH	£12.95
						What Next?	Gm	Baust Computing	4K	D HA	£6.95
						What Next?	Gm	Baust Computing	4K	C HA	£3.95
						Zossed in Space	Gm	Adventure Int.	16K	D AB	£14.35
						Zossed in Space	Gm	Adventure Int.	16K	C CH	£10.00
						Valley	Gm	CT Software	16K	C PF	£9.95

REFERENCE

SOFTWARE LISTING

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Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes & Prices
3-D Supergraphics	Ut	United S/W of America	48K	C BC	\$29.95
3-D Supergraphics	Ut	United S/W of America	48K	D AB	\$39.95
6502 Disassembler	Ut	Quality S/W	16K	C BC	\$8.95
6502 Disassembler	Ut	Quality S/W	16K	D BC	\$11.95
747 Landing Simulation	Gm	Atari	24K	C GC	POA
				AB	\$16.75
Adventureland	Gm	Adventure Int.	24K	C BC	\$14.95
				AB	\$16.50
Adventures 1-12	Gm	Adventure Int.	32K	C CH	\$16.50
Air Strike	Gm	English S/W	16K	C CH,HM	\$15.95
Alpha Fighter	Gm	Dinacomp	24K	C AB	\$11.99
Analogue Adventure	Gm		32K	D BC	\$34.95
Angle Worms	Gm	Adventure Int.	8K	C AB	\$12.50
Ants Hill	Gm	Atari	8K	C GC	POA
				AB	\$11.25
Armoured Patrol	Gm	Adventure Int.	16K	C AB	\$16.50
Assembler Editor	Ut	Atari	R	AB,HM	\$39.95
Assembler	Ut	Quality S/W	16K	C BC	\$14.95
Assembler Editor	Ut	United S/W of America	16K	R BC	\$34.50
Asteroids	Gm	Atari	16K	R AC, BC,CH, HM	\$29.95
				BC	\$18.95
Atari Word Processor	Bs	Atari	32K	C AB	\$95.95
Atari Word Processor	Bs	Atari	32K	C BC	\$85.00
Atari Word Processor	Bs	Atari	32K	D HM	\$99.95
Atari World Graphics	Ut	United S/W of America	48K	D BC	\$43.95
Avalanche	Gm	Atari	16K	C GC	POA
				CH	\$13.95
				AB	\$16.75
Babel	Gm	Atari	16K	C GC	POA
				AB	\$16.75
Balrog Sampler	Gm	Adventure Int.	32K	C AB	\$24.95
Basic A Plus	Ut	OSS S/W	48K	D BC	\$52.50
Basic A Plus and Operating System A	Ut	OSS S/W	48K	D BC	\$99.50
Basic Program Compress.	Ut	Atari	32K	D AB	\$16.75
Basic Utility/Renumber	Ut	Atari	16K	C AB	\$16.75
Basics of Animation	Ed	Santa Cruz	24K	D BC	\$10.95
Basics of Animation	Ed	Atari	16K	C BC	\$9.95
Basics of Animation	Ed	Santa Cruz	16K	C AB	\$13.95
Basketball	Gm	Atari	16K	C AC,HM	\$24.50
Basketball	Gm	Atari	16K	R AB,BC	\$29.95
Beneath the Pyramids	Gm	Chrystal	48K	C CH,AB	\$19.99
Black Jack	Gm	Atari	16K	C GC	POA
				AC,BC	\$8.95
				AB,HM	\$9.95
Black Jack Shooter	Ed	Atari	16K	C AB	\$16.75
Bob's Business	Bs	Santa Cruz	16K	C AB	\$9.95
British Heritage Jigsaw Puzzle	Gm	Thorn EMI	16K	C BC,HM	\$19.95
Bumper Pool	Gm	Atari	16K	C GC	POA
				AB	\$11.25
Calculator	Bs	Atari	24K	D BC	\$16.95
Caverns of Mars	Gm	Atari	16K	C BC,HM	\$24.50
Caverns of Mars	Gm	Atari	16K	C BC,HM	\$24.50
Centipede	Gm	Atari	16K	R GC	POA
				BC,HM	\$29.95
Champelo	Gm	Dinacomp	16K	C AB	\$10.99
Character Generator	Ut	Data Soft	16K	C BC	\$9.97
Character Generator	Ut	Data Soft	16K	D BC	\$12.50
Checker Kim	Gm	Personal S/W	16K	C BC	\$15.95
Chrystals	Gm	Dinacomp	24K	C AB	\$9.99
Code Cracker	Gm	Atari	8K	C GC	POA
				AB	\$11.25
Computer Acquire	Gm	Avalon Hill	16K	C GB	\$17.25
Computer Chess	Gm	Atari	16K	R GC	POA
				CH,AC,HM	\$24.95
				AB,BC	
Conflict 2500	Gm	Avalon Hill		C GB,AB	\$12.50
Controller	Gm	Avalon Hill	32K	D BH	\$17.95
Conversational French	Ed	Atari	16K	C AC,BC	\$32.50
Conversational French	Ed	Atari	16K	R AB,HM	\$39.95
Conversational German	Ed	Atari	16K	C AC,BC	\$32.50
Conversational German	Ed	Atari	16K	R AB,HM	\$39.95
Conversational Italian	Ed	Atari	16K	R AB,HM	\$39.95
Conversational Italian	Ed	Atari	16K	C AC,BC	\$32.50
Conversational Spanish	Ed	Atari	16K	R AB,HM	\$39.95
Conversational Spanish	Ed	Atari	16K	C AC,BC	\$32.50
Convoy Raider	Gm	Avalon Hill	16K	C BH	\$10.95
				GB,AB	\$12.50
Cribbage and Dominoes	Gm	Thorn EMI	16K	C CH,BC,HM	\$14.95
Crush, Crumble, Chomp	Gm	Avalon Hill	16K	C GB	\$15.50
Crush, Crumble, Chomp	Gm	Avalon Hill	16K	D GB	\$17.95
Crypts of Terror	Gm	In Home S/W	16K	C CH,HM	\$19.95
Curse of Crawley Manor	Gm	Adventure Int.	16K	C AB	\$16.50
Cypher Bowl	Gm	Artsci Inc.	32K	D BC	\$22.45
D1 Nuclear Bomber	Gm	Avalon Hill	16K	C BH	\$10.95
Darts	Gm	Thorn EMI	16K	C CH,BC,HM	\$19.95
Data Management S/W	Bs	C E S/W	48K	D AB	\$101.00
Data Management System	DO	Atari	32K	D AB	\$20.50
Datestone of Ryn	Gm	Avalon Hill		D GB	\$15.50
Datestone of Ryn	Gm	Avalon Hill		C BC	\$14.95
				GB	\$13.50
Deflections	Gm	Adventure Int.	8K	C AB	\$12.50
Disc Fixer	Ut	Atari	16K	D AB	\$22.50
Display List	Ed	Santa Cruz	16K	C BC	\$9.95
Display List	Ed	Santa Cruz	16K	D BC	\$10.95
Dnieper River	Gm	Avalon Hill	48K	C BH	\$15.95
				CH	\$14.50
				POA	
Domination	Gm	Atari	24K	C GC	\$16.75
				AB	\$16.75
Dos 2	Ut	Atari	32K	D AB	\$21.95
Dragon of Hong Kong	Gm	Adventure Int.	32K	C AB	\$16.50
Eastern Front	Gm	Atari	16K	C CH	\$24.95
Eastern Front	Gm	Atari	16K	D BC	\$30.25
Empire of the Overmind	Gm	Avalon Hill		C BH	\$17.95
				CH	\$18.95
Empire of the Overmind	Gm	Avalon Hill		D GB,AB	\$24.95
Escape from Tramm	Gm	Adventure Int.	16K	C AB	\$16.50
European Capitals	Ed	Atari	16K	C AC,BC	\$8.95
				AB,HM	\$9.95
European Scene Jigsaw Puzzle	Gm	Thorn EMI	16K	C BC,HM	\$19.95
Extended WSNA	Ut	Atari	16K	C AB	\$19.00
Fantasy land 2041	Gm	Chrystal	48K	C CH,AB	\$34.99
Fastgammon	Gm	Quality S/W	16K	C BC	\$9.95
Forest Fire	Gm	Dinacomp	24K	C AB	\$15.99
Frog	Gm	C E S/W	16K	C AB	\$9.95
Galactic Chase	Gm	Spectrum	16K	C AB,BC,HM	\$15.99
Galactic Chase	Gm	Spectrum	16K	D AB	\$20.25
Galactic Chase	Gm	Spectrum	16K	D BC,HM	\$17.95
Galactic Empire	Gm	Adventure Int.	32K	C BC	\$14.95
				AB	\$16.50
Galactic Guest	Gm	Chrystal	48K	C CH,AB	\$19.99
Galactic Trader	Gm	Adventure Int.	32K	C AB,CH	\$16.50
Galaxy	Gm	Avalon Hill	16K	C BH	\$12.95
Galaxy	Gm	Avalon Hill	16K	D BH	\$14.95
Ghost Hunter	Gm	Arcade Plus	16K	C CH	\$16.95
Ghost Town	Gm	Adventure Int.	24K	C BC	\$14.95
				AB	\$16.50
Giant Slalom	Gm	Dinacomp	16K	C AB	\$11.99
Golden Voyage	Gm	Adventure Int.	24K	C BC	\$14.95
				AB	\$16.50
Gomoku	Gm	Artsci Inc	16K	C BC	\$14.95
Graph it	Ut	Atari	16K	C AC,BC	\$11.95
				AB,HM	\$13.95
Graphic Sound Demo	Gm	Atari	16K	D GC	POA
				AB	\$16.75
Graphics Machine	Ut	Santa Cruz	16K	C AB	\$13.50
Guns of Fort Defiance	Gm	Avalon Hill	32K	C BH	\$12.95
HMS Impetuous	Gm	Adventure Int.	32K	C AB	\$16.50
Hangman	Gm	Atari	16K	C AC,BC	\$8.95
				AB,HM	\$9.95
Hickory Dickory Dock	Gm	Thorn EMI	16K	C BC,HM	\$19.95
Home Financial Mg'ment	Dm	Thorn EMI	16K	D HM	\$29.95
Horizontal/Vertical Scrolling	Ed	Santa Cruz	16K	C AB	\$13.95
House of Usher	Gm	Chrystal	48K	C AB,CH	\$19.99
Humpty Dumpty/Jack & Jill	Gm	Thorn EMI	16K	C BC,HM	\$19.95
Intruder Alert	Gm	Dinacomp	16K	C AB	\$15.99
Invasion Orion	Gm	Avalon Hill		C GB	\$13.25
Invasion Orion	Gm	Avalon Hill		D GB	\$15.75
Invitation to Prog I	Ed	Atari	16K	C AB,HM	\$15.95
Invitation to Prog. II	Ed	Atari	16K	C GC	POA
				AB,BC,HM	\$22.95
Invitation to Prol. III	Ed	Atari	16K	C AB,BC,HM	\$22.95
Jawbreaker	Gm	On Line	48K	D BC	\$22.95
Jumbo Jet Lander	Gm	Thorn EMI	16K	C BC,HM	\$29.95
K Dos	Ut	K Bite	32K	D BC	\$53.95
Kids I	Ed	Santa Cruz	16K	C AB	\$9.95
Kids II	Ed	Santa Cruz	16K	C AB	\$9.95
Kingdom	Gm	Atari	16K	C AC,BC	\$8.95
				AB,HM	\$9.95
Krazy Shoot Out	Gm	K Bife	16K	C BC,CH,HM	\$29.95
Lazerwords	Gm	Chrystal	16K	C AB	\$19.99
Letter Writer	Bs	C E S/W	16K	C AB	\$19.95
Little Chrystal	Gm	Chrystal	48K	C CH,AB	\$26.99
Little Red Riding Hood	Gm	Adventure Int.	16K	C AB	\$12.50
Local Call for Death	Gm	Adventure Int.	32K	C AB	\$16.50
Lords of Karma	Gm	Avalon Hill	48K	C CH,BH	\$12.95
Lords of Karma	Gm	Avalon Hill	48K	D CH,BH	\$14.95
Lunar Lander	Gm	Adventure Int.	16K	C AB	\$16.50
Macro Assembler	Ut	Atari	32K	R BC,HM	\$59.95
Matchmaker	Gm	Adventure Int.	16K	C AB	\$12.50
Micro Chess	Gm	Personal S/W	16K	C BC	\$15.95

Microsoft Basic	Ut Atari	C AB,BC,HM	£59.95	Outlaw Howitzer	Gm Atari	24K C GC	POA
Midway Campaign	Gm Avalon Hill	32K C AB	£12.50	Pac-Man	Gm Atari	16K R GC	£16.75
Mind Bogglers	Gm Versa Computing	16K C BC	£8.95			BC,HM	POA
Mini Wordprocessor	Ed Santa Cruz	32K C AB	£9.95	Page Flipping	Ed Santa Cruz	16K C BC	£29.95
Minotaur	Gm Atari	24K C GC	POA	Page Flipping	Ed Santa Cruz	16K D BC	£9.95
		AB	£11.25	Personal Finance	Gm Atari	R BC,HM	£10.95
				Pilot (Educator)	Ut Atari	16K	£49.00
Missile Command	Gm Atari	16K R BC,AC,CH				C/R AB,BC,HM	£79.95
		HM	£29.95	Pirate Adventure	Gm Adventure Int.	24K C BC	£14.95
Mission Impossible	Gm Adventure Int.	24K C BC	£14.95			AB	£16.50
		AB	£16.50				
Monarch	Gm Dinacomp	16K C AB	£10.99	Planet Miners	Gm Avalon Hill	24K C BH	£10.95
Moon Probe	Gm Dinacomp	16K C AB	£9.99	Player Missile Graphics	Ed Santa Cruz	24K D BC	£19.95
Mortgage Loan Analysis	Ed Atari	16K C AB,BC,HM	£13.95	Player Missile Graphics	Ed Santa Cruz	24K C BC	£18.95
Mountain Shoot	Gm Adventure Int.	16K C AB	£16.50			AB	£19.95
Mountain Shoot	Gm Analog S/W	16K C BC	£10.95	Poker & Solitaire	Gm Artsi Inc.	16K C BC	£10.95
Mouskattack	Gm On Line	D CH	£22.95	Program Pack I	Ut Avalon Hill	16K C GB	£3.50
Movie Scenes	Gm Atari	16K C BC	£9.95	Purchase Ledger	Bs Atari	48K C AB	£149.95
Moving Maze	Gm Dinacomp	16K C AB	£9.99	Pyramid of Doom	Gm Adventure Int.	24K C BC	£14.95
Music Composer	Gm Atari	16K R AC,BC	£32.50			AB	£16.50
		AB,HM	£35.95	QS Forth	Ut Quality S/W	24K D BC	£44.90
Mystery Funhouse	Gm Adventure Int.	24K C BC	£14.95	Quest for Power	Gm Chrystal	48K C CH,AB	£26.99
		AB	£16.50	Race in Space	Gm Analog S/W	16K C BC	£14.95
Nomino's Jigsaw	Gm Dinacomp	24K C AB	£15.99	Rescue at Rigel	Gm	32K C BC	£22.45
Norton Forth	Gm Adventure Int.	32K C AB	£24.95	Reversi	Gm Artsi Inc	16K C BC	£14.95
				Rings of the Empire	Gm Dinacomp	16K C AB	£15.99
Nuke War	Gm Avalon Hill	16K C BH	£10.95	Rotate and Tilt	Gm Thorn EMI	16K C BC,HM	£14.95
		AB	£16.50	Sales Ledger	Bs Atari	48K C AB	£149.95
Old McDonald's Farm	Gm Adventure Int.	16K C AB	£12.50	Sands of Mars	Gm Chrystal	48K C CH,AB	£26.99
Operating System A Plus	Ut OSS S/W	48K D BC	£52.50	Savage Island I	Gm Adventure Int.	24K C BC	£14.95



REFERENCE

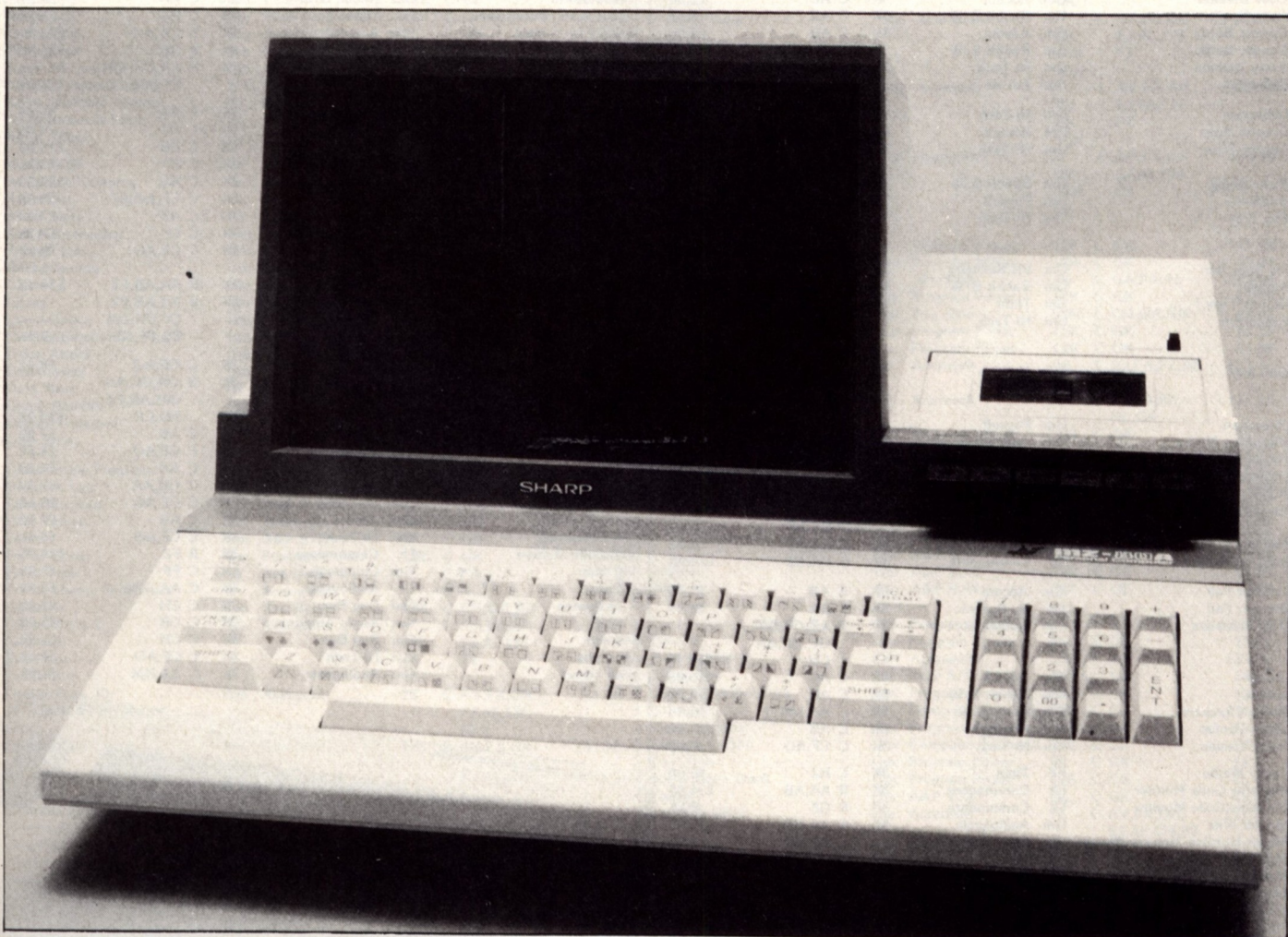
SOFTWARE LISTING

Savage Island II	Gm	Adventure Int.	24K	C BC	£14.95	Super Breakout	Gm	Atari	16K	C AC,HM	£24.50
Scram	Gm	Atari	16K	C GC	£16.50	Super Breakout	Gm	Atari	16K	R AB	£35.95
Shooting Gallery	Gm	Analog S/W	16K	C BC	£17.50	Tack Trek	Gm	Atari	24K	C GC	£13.50
Six Microstories	Gm	Adventure Int.	32K	C AB	£14.95					AB	£8.95
Sky Warrior	Gm	Adventure Int.	16K	C AB	£12.50	Tank Trap	Gm	Quality S/W	16K	C BC	£11.95
Snooker and Billiards	Gm	Thorn EMI	16K	C BC,HM	£16.50	Tank Trap	Gm	Quality S/W	16K	D BC	£16.95
Sound Editor	Gm	Atari	16K	C GC	£16.75	Tanktics	Gm	Avalon Hill	32K	C CH	£8.95
Sound Tutorial	Ed	Santa Cruz	16K	C AB	£13.95	Tari Trek	Gm	Quality S/W	16K	C BC	£11.95
Space Invaders	Gm	Atari	16K	R AB,CH,H-	£29.95	Tari Trek	Gm	Quality S/W	16K	D BC	£21.50
Space Tilt	Gm	Dinacomp	16K	C AB	£9.99	Tele Link	Ut	Atari	16K	R HM	£19.95
Space Trap	Gm	Dinacomp	24K	C AB	£12.99	Telelink	Ut	Data Soft	16K	R BC	£14.95
Space Trek	Gm	Atari	24K	C GC	£13.50	Terrie	Gm	Atari	32K	C GC	£16.75
Star Raiders	Gm	Atari	16K	R HM,AC,BC	£29.95	Text Wizard	Ut	Data Soft	16K	D AB	£99.95
Star Trek 3.5	Gm	Adventure Int.	32K	C BC	£14.95	The Count	Gm	Adventure Int.	24K	C BC	£14.95
Star Warrior	Gm	Epyx	32K	C BC	£28.95					AB	£16.50
States and Capitals	Ed	Atari	16K	C AC,BC	£8.95	Threshold	Gm	On-Line	32K	C HM	£24.95
Statistics I	Gm	Atari		C AC,BC	£11.95	Thunder Island	Gm	Analog S/W	16K	C BC	£10.95
Stock and Bonds	Gm	Avalon Hill	32K	C BH	£12.95	Touch Typing	Ed	Atari	16K	C AC,BC	£14.95
Stone of Sisythus	Gm	Adventure Int.	32K	C AB	£24.95					AB,HM	£15.95
Strange Odyssey	Gm	Adventure Int.	24K	C BC	£14.95	Tournament Pool and	Gm	Thorn EMI	16K	C CH,BC,HM	£19.95
Stud Poker	Gm	Dinacomp	16K	C AB	£10.99	8 Ball Pool	Gm	Dinacomp	16K	C AB	£12.99
Submarine Commander	Gm	Thorn EMI	16K	C BC,HM	£24.50	Triple Blockade	Gm	Adventure Int.	32K	C AB	£16.50
Summer	Gm	Chrystal	16K	C AB	£11.99	Two Heads of the Coin	Gm	Atari	16K	R GC	£16.50
Sunday Golf	Gm	Adventure Int.	16K	C AB	£16.50	Video Easel				AB,BC,HM	£24.50
						Visicalc	Bs	Personal S/W	32K	D BC	£119.95
						Voodoo Castle	Gm	Adventure Int.	24K	C BC	£14.95
						Voyager	Gm	Avalon Hill	32K	C CH,BH	£12.95
						Waterloo	Gm	Chrystal	48K	C CH	£32.99
						Wizard and the Princess	Gm	On Line	48K	D CH	£22.95
						World War III	Gm	Chrystal	48K	C CH,AB	£19.99

SHARP MZ-80K

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes & Prices
3-D Basic	Gm	Kuma	6K	C AX,AO,AB	£6.32
Address Book	Gm	Highlight S/W	4K	C CC,AB	£4.60
Aladdin's Cave	Gm	Kuma		C AX,CH	£6.32
Aldebaren I	Gm	Sharpsoft	20K	C CH	£5.85
Alien Attack	Gm	J Wolstencroft	24K	C CZ	£4.60
Analysis Book	Bs	Microtek	48K	C EQ	£95.00
Animate	Gm	Kuma	48K	C AX,AB,AO	£9.20
Apollo Front Panel	Bs	Kuma	20K	C AX	£14.35
Apolloword	Bs	Kuma	48K	C AX,AC,AO	£28.70
Apolloword	Bs	Kuma	48K	D AX,AC,AO	£63.25
Ardensoft Toolkit	Ut	Kuma	20K	C AX	£40.25
Asteroids	Gm	Sharpsoft	20K	C CH	£5.85
Astro Dodge	Gm	Kuma		C AX,CH	£6.32
Auto Cross	Gm	Highlight S/W	6K	C CC,AB	£4.60
Backgammon	Gm	Highlight S/W	10K	C CC,AB	£5.75
Bank Account	Do	Highlight S/W	6K	C CC,AB	£4.60
Basic Compiler	Ut	Sharp	48K	C AB	£34.50
Basic Extensions	Ut	Kuma	20K	C AX,AO,AB	£14.95
Basic Plus	Ut	Kuma		C AX	£13.80
Bio-Rhythm	Gm	Highlight S/W	6K	C CC,AB	4.60
Block QC	Gm	Sharpsoft	20K	C AB	£3.50
Block Stop	Gm	J Wolstencroft	24K	C CZ	£4.60
Blockade	Gm	Kuma	48K	C AX,AO,AB	£6.32
Bomber	Gm	Kuma	6K	C AX,AO,AB	£6.32
Breakout	Gm	Kuma	48K	C AX,AO,AB	£6.32
Breakout	Gm	Sharpsoft	20K	C AB	£5.75
Bridge	Gm	Highlight S/W	22K	C CC	£12.95
Brownian Motion	Ed	Kuma		C AX	£12.00
CPM	Ut	Chrystal	48K	C AX,AO	£172.50
Calc II	Bs	Kuma	20K	C AX,AO,FZ	£39.65
Camelot	Gm	Kuma	48K	C AX,AC,AB	£6.32
				AO,FZ	£6.32
Carols	Gm	Kuma	48K	C AX,AO,AB	£6.32
Cash Book	Bs	Microtek	48K	C EQ	£95.00
Casino	Gm	Kuma		C AX	£6.32
Catch 2000/Invader	Gm	Kuma	12K	C AX,AO,AB	£6.32
Cesil III	Ed	Kuma	20K	C AX	£17.20
Chase	Gm	Highlight S/W	6K	C CC,AB	£5.75
Chess	Gm	Kuma	12K	C AX,AO,FZ,CH	£12.00
Children's Maths	Ed	Kuma		C AX	£6.32
Chrystal Basic	Ut	Chrystal	48K	C AX,AO	£46.00
Colditz	Gm	Sharpsoft	20K	C CH	£8.46
Combat	Gm	Highlight S/W	6K	C CC,AB	£5.75
Combat	Gm	Kuma	12K	C AX,AO,AB	£6.32
Commands	Gm	Sharpsoft	20K	C AB	£5.85
Composer	Gm	Highlight S/W	6K	C CC,AB	£5.75
Concentration	Gm	Kuma	12K	C AX,AO,AB	£6.32
Connect 4	Gm	Highlight S/W	6K	C CC,AB	£4.60
Cosmiad	Gm	Highlight S/W	10K	C CC,AB	£5.75
Cosmiad	Gm	Kuma	12K	C AX,AC,AO,AB	£9.20
Count and Add	Ed	Highlight S/W	22K	C CC,AB	£5.75
Cribbage	Gm	Kuma	12K	C AX,AO	£12.00
Cricket	Gm	Kuma		C AX	£6.32
Cursed Chambers	Gm	J Wolstencroft	48K	C CZ	£5.75
Data Base	Bs	Kuma	48K	C AX,AO	£33.95
Data File	Gm	Gamer	48K	C CZ	£29.95
Disassembler	Ut	Kuma	20K	C AX,AO,AB	£12.00
Donky Derby	Gm	Kuma	12K	C AX,AO,AB	£6.32
Double Precision Basic	Ut	Sharp	48K	C AB	£28.75
Double Precision Basic	Ut	Sharp	48K	D AX	£46.00
Drunken Driver	Gm	Highlight S/W	6K	C CC,AB	£5.75
Dybug	Ut	Kuma		C AX	£16.65
Editor Assembler	Ut	Sharp	48K	C AB	£15.50
Editor Assembler	Ut	Sharp	48K	D AX	£51.75
Election '84	Gm	Sharpsoft	20K	C CH	£8.45
Electronic Organ	Gm	Kuma	12K	C AX	£6.32
Electrons I	Ed	Kuma		C AX	£12.00
Electrons II	Ed	Kuma		C AX	£12.00
Empire II	Gm	Sharpsoft	20K	C AB	£5.85
Enigma	Gm	Kuma	12K	C AX	£6.32
Escape Forth	Gm	J Wolstencroft	24K	C CZ	£4.60
Evasion	Gm	Kuma	6K	C AX,AO	£6.32
Executive	Gm	Kuma	6K	C AX,AB	£9.20
Exploring Africa	Gm	Kuma	6K	C AX,AB	£6.32
F DOS	Ut	Sharp	48K	C AB	£57.50
Fall Out	Gm	Kuma	6K	C AX,AO	£6.32
Fireballs	Gm	Kuma	6K	C AX,AB	£6.32
Football Manager	Gm	Highlight S/W	10K	C CC,AB	£5.75
Forth	Ut	Kuma		C AX	£40.20
Foundry Package	Bs	Microtek	48K	C EQ	£16.50
Four in a Row	Gm	Kuma	6K	C AX,AO,AB	£6.32
Fox and Geese	Gm	Highlight S/W	6K	C CC,AB	£4.60
Fruit Machine	Gm	Kuma	6K	C AX,AO,AB	£6.32
Full Accounting	Bs	Microtek	48K	C EQ	£16.50
Guess Word	Gm	Kuma	6K	C AX,AB	£6.32
Hangman	Gm	Kuma	6K	C AX,AO,AB	£6.32
Head On	Gm	Highlight S/W	10K	C CC,AB	£6.90
Head On	Gm	Kuma	6K	C AX,AO,AB	£6.32
Head On	Gm	Sharpsoft	20K	C CH	£5.85
Hissing Sid	Gm	Kuma		C AX	£6.32
Home Budget I	Do	Kuma	6K	C AX,AC,AO,AB	£6.32
Hunter Killer	Gm	Kuma	48K	C AX,AB	£6.32
I Spy	Ed	Highlight S/W	22K	C CC	£5.75
Instant Addition And The Four					
Rules	Ed	Kuma		C AX	£6.32
Intruder	Gm	Kuma	48K	C AX,AO,AB	£6.32
Invaders	Gm	Kuma	20K	C FZ	£6.30
J S Line 4	Gm	Kuma	48K	C AX,AB	£6.32
Junior Maths and Stepping					
Stones	Ed	Kuma		C AX	£6.32
Juntori	Gm	Sharpsoft	20K	C AB	£5.85
Kentucky Derby	Gm	Kuma		C AX	£6.32
Knights Commander	Ut	Knights	48K	C AX	£28.75
Knights Commander	Ut	Knights	48K	D AX	£74.75
Knights Fortran	Ut	Knights	48K	C AX	£34.50
Knights Wee Pascal	Ut	Knights	48K	C AX	£23.00
Large Display	Gm	Kuma	48K	C AX	£6.32
Las Vegas	Gm	Sharpsoft	20K	C AB	£5.85
Life	Gm	Kuma	48K	C AX,AO,AB	£9.20

Lunar	Gm Kuma	48K C AX,AO,AB	£6.32	Semi Conductors I	Ed Kuma	C AX	£12.00
Lunar Lander	Gm Kuma	48K C AX,AO,AB	£6.32	Semi Conductors II	Ed Kuma	C AX	£12.00
MZ Othello	Gm Kuma	48K C AX	£12.00	Shape Match	Gm Kuma	48K C AX,AO	£6.32
Madness	Gm J Wolstencroft	24K C CZ	£4.60	Shapes	Ed Highlight S/W	22K C CC,AB	£5.75
Maniac	Gm Highlight S/W	6K C CC,AB	£5.75	Sharp Demo	Gm Kuma	48K C AX,AO	£6.32
Map of England	Gm Kuma	48K C AO	£6.32	Show Jumping	Gm Kuma	48K C AX,FZ	£6.32
Map of England	Gm Kuma	48K D AX	£12.00	Shudo	Gm Kuma	48K C AX	£6.32
Mastermind	Gm Highlight S/W	6K C CC,AB	£4.60	Simon	Gm Kuma	48K C AX	£6.32
Mastermind	Gm Kuma	48K C AX,AO,FZ,AB	£6.32	Slave Interpreter	Ut Kuma	C AX	£16.65
Match the Character	Ed Highlight S/W	22K C CC,AB	£4.60	Snakes and Ladders	Gm Kuma	48K C AX,AO	£6.32
Match the Word	Ed Highlight S/W	22K C CC,AB	£5.75	Solid State Non VAT			
Maths	Ed Highlight S/W	22K C CC	£5.75	Accounts	Ed Kuma	C AX	£33.90
Melody	Gm Kuma	48K C AX	£6.32	Solid State VAT Accounts	Ed Kuma	C AX	£33.90
Memory Tests	Ut Kuma	20K C AX,AO,AB	£6.32	Space Battle	Gm Kuma	48K C AX,AO,AB	£6.32
Minefield	Gm Kuma	48K C AX	£6.32	Space Invaders	Gm Kuma	48K C AX,AO,AC,AB	£6.32
Miz-Maze	Gm Kuma	48K C AX,AO	£6.32	Space Pursuit	Gm Kuma	48K C AX,AO,AB	£6.32
Monkey Climb	Gm Kuma	48K C AX,AO	£6.32	Star Trek	Gm Kuma	10K C AX,AC,AO	£6.32
Moonlander	Gm Highlight S/W	10K C CC,AB	£5.75	Stock Control/Invoicing	Bs Microtek	48K C EQ	£316.00
Mortar Attack	Gm Kuma	48K C AX,AO	£6.32	Stomper	Gm Kuma	10K C AX,FZ,AB	£6.32
Music Composer/Editor	Ed Kuma	48K C AX,AC,AB	£12.00	Stomper/Minefields	Gm Sharpsoft	20K C AB	£5.85
Narpex	Ed Kuma	C AX	£28.70	Submarine	Gm Kuma	10K C AX,AO	£6.32
Newton/Conservation	Ed Kuma	C AX	£12.00	Super Simon	Gm Kuma	48K C AX,AO	£6.32
Pac Man	Gm Kuma	C AX	£9.20	Supercopy	Ut Kuma	20K C AX	£12.00
Pascal	Ut Sharp	48K C AB	£34.50	Superfire	Gm Kuma	48K C AX	£6.32
Patience	Gm Kuma	48K C AX,AO	£6.32	Supermouse	Gm Kuma	48K C AX,CH	£6.32
Payroll	Bs Microtek	48K C EQ	£65.00	Swordmen	Gm Kuma	48K C AX,AO	£9.20
Picture Count	Ed Highlight S/W	22K C CC,AB	£5.75	Tank Wall	Gm Kuma	48K C AX,AO	£6.32
Pilot	Ut Kuma	C AX	£17.25	Tenpin Bowling	Gm Kuma	48K C AX,AO	£6.32
Poker	Gm Kuma	48K C AX,AO,AB	£6.32	Timetabling Aid	Ed Kuma	20K C AX	£22.45
Pontoon	Gm Kuma	48K C AX,AO,AB	£6.32	Towering Inferno	Gm Sharpsoft	20K C CH,AB	£5.85
Poseidon	Gm Highlight S/W	6K C CC, AB	£5.75	Towers of Hanoi	Gm Kuma	48K C AX	£6.32
Princess & Monster Maze	Gm Kuma	48K C AX,AB	£6.32	Track Layer	Gm Kuma	48K C AX,CH	£6.32
Program Filing Index	Bs Kuma	20K C AX	£6.32	Trader Smith	Gm Kuma	48K C AB	£6.32
Quadrax	Gm Kuma	48K C AX,AO,AB	£6.32	Tycoon	Gm Kuma	48K C AX,AO	£6.32
Quest	Gm J Wolstencroft	48K C CZ	£4.60	UFO	Gm Kuma	6K C AX,AC	£6.32
Race Track	Gm Kuma	48K C AX,AO,AB	£6.32	Waves I	Ed Kuma	C AX	£12.00
Racing	Gm Kuma	48K C AX	£6.32	Waves II	Ed Kuma	C AX	£12.00
Raider	Gm Kuma	48K C AX,AO,AB	£6.32	Wordpro	Bs Kuma	48K C AX,AC	£45.45
Reactor	Gm Kuma	48K C AX,AB	£6.32	Zen Dos	Bs Kuma	48K C AX,AC	£91.95
Rhymes	Gm Kuma	48K C AX,AB	£6.32	Zen Editor Assembler	Ut Kuma	4K C AX	£66.16
Road Hunter	Gm Kuma	48K C AX,AO,AB	£6.32	Zenmod	Ut Kuma	20K C AX,AO,AB	£22.45
Rocket	Ed Kuma	C AX	£6.32		Ut Kuma	4K C AX,AB	£12.00



REFERENCE

SOFTWARE LISTING

VIC20

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes & Prices
3-D Maze	Gm	Adcom	8K	C AB	£7.50
3-D Maze	Gm	Hi-Tech	3K	C FZ	£8.30
A-Maz-Ing	Gm	Audiogenic	8K	C AA,CH,HM	£6.99
Alien	Gm	Commodore	3K	R FZ,AB,GF CF,DM,CH FD,FP,AA	£19.95
Alien Attack	Gm	Adcom	5K	C AB	£7.00
Alien Attack	Gm	Hi-Tech	3K	C CF,AO	£8.62
Alien Blaster	Gm	Paysoft	5K	C FP	£5.25
Alien Blitz	Gm	Audiogenic	3K	C AA,HM	£7.99
Alien Blitz	Gm	Audiogenic	5K	C CH	£7.99
Alien Maze	Gm	Adcom	8K	C AB	£7.50
Alien Maze	Gm	Hi-Tech	3K	C FZ	£8.30
Alien Wars	Gm	Hi-Tech	3K	C FZ CF,AO AY	£8.62 £7.80
Amok	Gm	Audiogenic	5K	C AA,HM	£6.99
Ant Raiders	Gm	PR Software	3K	C GV	£7.50
Asteroid Belt	Gm	Adcom	8K	C AB	£7.50
Asteroid Belt	Gm	Hi-Tech	3K	C CF,AO	£8.62
Asteroids	Gm	Bug Byte	5K	C CH	£7.00
Avenger	Gm	Commodore	3K	R FZ,AB,GF CF,DM,CH FD,FP,AA	£19.95
Balloon Bomber	Gm	Hi-Tech	3K	C CF,AO	£8.62
Blitz	Gm	Commodore	3K	C FD	£4.99
Car Drive	Gm	Adcom	5K	C AB	£7.00
Car Drive	Gm	Hi-Tech	3K	C FZ AY CF	£8.30 £7.80 £8.62
Car Race	Gm	Adcom	5K	C AB	£7.00
Car Race	Gm	Hi-Tech	3K	C CF,AO	£8.62
Charset 20	Gm	Adcom	8K	C AB	£8.00
Charset 20	Gm	Rabbit S/W	3K	C AH	£4.99
Code Breaker	Gm	Adcom	5K	C AB	£5.00
Code Breaker	Gm	Rabbit S/W	3K	C AH	£2.99
Cosmic Battle	Gm	Adcom	5K	C AB	£8.00
Cosmic Battle	Gm	Rabbit S/W	3K	C AH	£4.99
Crazy Balloon	Gm	Hi-Tech	3K	C CF,AO	£8.62
Deflection	Gm	Adcom	5K	C AB	£7.00
Deflection	Gm	Hi-Tech	3K	C CF,AO	£8.62
Dragon Maze	Gm	Adcom	8K	C AB	£7.50
Dragon Maze	Gm	Hi-Tech	3K	C FZ CF,AO	£8.30 £8.62
Dune Buggy	Gm	Rabbit S/W	3K	C AH	£4.99
Duplicate	Gm	Paysoft	5K	C FP	£5.25
Fire Trek	Gm	Hi-Tech	3K	C AY FZ CF,AO	£7.80 £8.30 £8.62
Fly Snatcher	Gm	PR Software	3K	C GV	£7.50
Frogger	Gm	Rabbit S/W	8K	C AH	£7.99
Games Tape I	Gm	Titan	3K	C HJ	£5.00
Grand Prix	Gm	Hi-Tech	3K	C FZ, 8.30 AY	£7.80
Gun Men	Gm	Hi-Tech	3K	C AY FZ CF,AO	£7.80 £8.30 £8.62
Hangman	Gm	Paysoft	5K	C FP	£5.25
Hangman Maths	Gm	Audiogenic	3K	C AA,HM	£7.99
Hesdon	Gm	Hi-Tech	3K	C CF,AO	£8.62
Highways Plot	Gm	Adcom	8K	C AB	£5.00
ICBM	Gm	Hi-Tech	3K	C CF,AO	£8.62
Invader Fall	Gm	Hi-Tech	3K	C FZ CF,AO	£8.30 £8.62
Indi 500	Gm	Hi-Tech	3K	C CF,AO	£8.62
Intro. to Basic I	Ed	Commodore	3K	C AA,AB	£14.95
Invader Fall	Gm	Adcom	8K	C AB	£7.50
Invader Fall	Gm	Audiogenic	3K	C AA	£6.99
Jelly Monsters	Gm	Commodore	3K	R AB,CF,DM GC,GF,AA CH	£19.95
Jungle	Gm	Adcom	5K	C AB	£6.00
Jungle	Gm	Rabbit S/W	3K	C AH	£4.99
Kiddy Checkers	Gm	Audiogenic	3K	C AA,HM	£6.99
Lunar Lander	Gm	Adcom	5K	C AB	£7.00
Lunar Lander	Gm	Hi-Tech	3K	C CF,AO	£8.62
Lunar Maths	Ed	Titan	3K	C HJ	£6.00
Machine Code Monitor	Ut	Commodore	3K	R AA,AB	£34.95
Machine Code Monitor	Ut	Commodore	3K	R GF	POA
Master Wits	Gm	Audiogenic	3K	C AA,HM	£6.99
Maths Hurdler/Monster Merge	Gm	Audiogenic	3K	C AA,HM	£7.99
Maze Men	Gm	Titan	3K	C HJ	£6.00
Memory Pack	Ut	Commodore	16K	R FZ	£74.95
Memory Pack	Ut	Commodore	3K	R FZ	£24.95
Memory Pack	Ut	Commodore	8K	R FZ	£44.95
Meteor Run	Gm	Anglo American	3K	R GB	£25.90
Meteoroid	Gm	Adcom	5K	C AB	£10.00
Missile Command	Gm	Adcom	5K	C AB	£9.00
Missile Commander	Gm	Hi-Tech	3K	C CF	£8.62
Moak	Gm	Audiogenic	5K	C CH	£6.99
Mole Attack	Gm	Hi-Tech	3K	C CF,AO	£8.62
Music Maker	Gm	Adcom	5K	C AB	£10.00
Naval Attack	Gm	Titan	3K	C HJ	£7.00
Naval Battle	Gm	Hi-Tech	3K	C CF,AO,FZ	£8.62
New York	Gm	Paysoft	5K	C FP	£5.25
Night Flight	Gm	Rabbit S/W	3K	C AH	£4.99
Othello	Gm	Hi-Tech	3K	C FZ CF AO,AY	£8.30 £8.62 £7.80
Pack Man	Gm	Hi-Tech	3K	C FZ AO AY	£8.30 £8.62 £7.80
Programmer's Aid	Ut	Commodore	3K	R AA,AB	£34.95
Rabbit Functions	Ut	Rabbit S/W	3K	C AH	£4.99
Rabbit Writer	Ut	Rabbit S/W	16K	C AH	£9.99
Road Race	Gm	Commodore	3K	R FZ,AB,GF CF,DM,CH GC,FD,FP AA	£19.95
Robot Zap	Gm	Paysoft	5K	C FP	£5.25
Rugby Game	Gm	Adcom	5K	C AB	£7.00
Rugby Game	Gm	Hi-Tech	3K	C CF,AO	£8.62
Seawolf/Bounceout	Gm	Audiogenic	3K	C AA,HM	£8.99
Simple Simon	Gm	Audiogenic	5K	C AA,HM	£6.99
Six Program Pack;	Gm	PR Software	3K	C GV	£7.50
War Game					
Smash Out					
Black Jack					
Logic					
Pick Up Game					
Alarm Clock					
Ski Run	Gm	Rabbit S/W	3K	C AH	£4.99
Skier	Gm	Hi-Tech	3K	C CF,AO	£8.62
Skimmetts	Gm	Audiogenic	3K	C AA	£6.99
Slot Machine	Gm	Hi-Tech	3K	C CF,AO	£8.62
Space Defence	Gm	Adcom	5K	C AB	£10.00
Space Defender	Gm	Hi-Tech	3K	C CF,AO	£8.62
Space Division	Gm	Audiogenic	3K	C AA	£6.99
Space Invaders	Gm	Hi-Tech	3K	C CF,AO,FZ	£8.62
Space Storm	Gm	Rabbit S/W	3K	C AH	£6.99
Space Wars/Battle Zone	Gm	Titan	3K	C HJ	£6.00
Spiders from Mars	Gm	Audiogenic	5K	R CH,AA	£24.99
Spiders of Mars	Gm	Anglo American	3K	R GB	£25.90
Star Battle	Gm	Commodore	3K	R AA,CH,AB CF,DM,GC	£19.95
Star Wars	Gm	Audiogenic	3K	C AA	£6.99
Star Wars II	Gm	Titan	3K	C HJ	£7.00
Stella Shootout	Gm	Adcom	5K	C AB	£15.00
Stunt Cycle	Gm	Coloursoft	5K	C FP	£7.75
Sub Attack/Missile Command	Gm	PR Software	3K	C GV	£7.50
Submarine	Gm	Hi-Tech	3K	C CF,AO,FZ	£8.62
Super Breakout	Gm	Adcom	5K	C AB	£7.00
Super Breakout	Gm	Coloursoft	5K	C FP	£7.75
Super Breakout	Gm	Hi-Tech	3K	C CF,AO	£8.62
Super Expander High					
Resolution Pack	Ut	Commodore	3K	R AA,AB,FZ	£34.95
Super Lander	Gm	Commodore	3K	R AA,AB,FZ CF,CH,DM FD,FP,GF	£19.95
Super Moonlander	Gm	Hi-Tech	3K	C CF,AO	£8.62
Super Slot	Gm	Commodore	3K	R CH,GC,AA DM,AB,FZ FD,CF	£19.95
Super Snake	Gm	Adcom	5K	C AB	£7.00
Super Snake	Gm	Hi-Tech	3K	C CF,AO	£8.62
Super Worm	Gm	Rabbit S/W	3K	C AH	£4.99
The Alien	Gm	Audiogenic	8K	C CH,AA	£7.99
Treasure Carrying	Gm	Hi-Tech	3K	C CF,AO	£8.62
UFO Shooting	Gm	Adcom	5K	C AB	£7.00
UFO Shooting	Gm	Hi-Tech	3K	C CF,AO	£8.62
VIC Code Monitor	Ut	Commodore	3K	R FZ	£34.95
VIC Men	Gm	Coloursoft	5K	C FP	£7.00
VICalc	Ut	Audiogenic	3K	C AA, HM	£6.99
Vicgammon	Gm	Bug Byte	8K	C CH	£7.00
Vicmen	Gm	Anglo American	3K	C GB	£7.00
Vicmen	Gm	Bug Byte	5K	C CH	£7.99
Vic Cube	Gm	Hi-Tech	3K	C CF,AO	£8.62
Wall Street	Gm	Audiogenic	3K	C AA,HM	£6.99





ATOM

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes & Prices
3-D Asteroids	Gm	Program Power	5K	C GK	£6.85
747 Flight Simulator	Gm	Bug Byte	12K	C CH,GA,GB	£8.00
Adventure	Gm	Program Power	12K	C CH,GK	£9.15
Adventures	Gm	Acornsoft	12K	C EJ	£30.00
Air Attack	Gm	Program Power	12K	C CH,GK	£9.15
Alien Maze	Gm	Program Power	8K	C GK	£5.69
Astro Birds	Gm	Program Power	12K	C CH,GK	£9.15
Atom Adventure	Gm	Acornsoft	12K	C GA,AL	£11.50
Atom Business Games	B/G	Program Power	12K	C GK	£7.99
Atom Business Cassette	Bs	Acornsoft		C AL	£7.50
Atom Business Pack	Bs	Acornsoft		C AY,FA	£11.50
Atom Chess	Gm	Acornsoft	12K	C GA,EA,AL	£11.50
Atom Forth	Ut	Acornsoft		C GA,EJ,AL	£11.50
Atom Life Category	Bs	Acornsoft		C AL,GA	£11.50
Atom List	Ut	Acornsoft		C AL	£17.25
Atom Store	Bs	Program Power	12K	C GK	£9.15
Atom Synthesiser	Gm	Acornsoft	12K	C AL,GA	£11.50
Atomic Cube	Gm	A&F S/W	12K	C GE	£4.95
Backgammon	Gm	Bug Byte	7K	C GA	£7.00
Chess	Gm	Bug Byte	12K	C CH,GA,GB	£9.00
Chess	Gm	Program Power	12K	C GK	£9.15
Constellation	Gm	Program Power	12K	C GK	£7.99
Cowboy Shootout	Gm	Program Power	12K	C CH,GK	£7.99
Cylon Attack	Gm	A&F S/W	12K	C GE	£4.95
Dambusters	Gm	Program Power	10K	C GK	£5.69
Data Base	Ut	Acornsoft	6K	C EJ,FZ,FA,GA	£11.50
Death Satellite	Gm	A&F S/W	12K	C GE	£6.00
Demon Dungeon	Gm	Program Power	5K	C GK	£6.85
Desk Diary	Bs	Acornsoft	12K	C FA,EJ,AL,GA	£11.50
Disassemble Program	Ut	Program Power	4K	C GK	£6.85
Dragon's Lair	Gm	Program Power	12K	C GK	£6.85
Early Warning	Gm	A&F S/W	12K	C GE	£4.95
Easy Talker	Ed	Acornsoft	16K	C AW	£5.00
Escape	Gm	A&F S/W	8K	C GE	£4.95
Fall of Rome	Gm	Program Power	12K	C GK	£7.99
Forth Tape	Ut	Acornsoft		C FA	POA
Forth, Theory & Practice	Bs	Acornsoft		C AL	£6.00
Galaxian	Gm	Bug Byte	12K	C CH,GA,GB	£8.00
Games Pack 1:	Gm	Acornsoft		C AY,FA,GA	£11.50
Asteroids			10K	EJ,AL,CH	
Sub Hunt			6K	FZ	
Break Out			4K		
Games Pack 10:	Gm	Acornsoft	2K	C AY,FA,GA	£11.50
10 Games for minimum				EJ,AL,CH, FZ	
Atom					
Games Pack 11:	Gm	Acornsoft	12K	C AY,FA,GA	£11.50
Missile Base				EJ,AL,CH	
Snooker					
Dominoes					
Games Pack 2	Gm	Acornsoft		C AY,FA,GA	
Dog Fight			10K	EJ,AL,CH	
Mastermind			4K	FZ	
Zombie			4K		
Games Pack 3:	Gm	Acornsoft		C AY,FA,GA	£11.50
Rat Trap			10K	EJ,AL,CH	
Lunar Lander			6K	FZ	
Black Box			10K		
Games Pack 4:	Gm	Acornsoft		C AY,FA,GA	£11.50
Star Trek			8K	EJ,AL,CH	
Four Row			12K	FZ	
Space Attack			10K		
Games Pack 5:	Gm	Acornsoft		C AY,FA,GA	£11.50
Invaders			10K	EJ,AL,CH	
Wumpus			3K	FZ	
Reversi			4K		
Games Pack 6:	Gm	Acornsoft		C AY,FA,GA	£11.50
Dodgems			10K	EJ,AL,CH	
Simon			8K	FZ	
Amoeba			6K		
Games Pack 7:	Gm	Acornsoft		C AY,FA,GA	£11.50
Life Forms			8K	EJ,AL,CH	
Ballistics			10K	FZ	
Snake			10K		
Games Pack 8:	Gm	Acornsoft		C AY,FA,GA	£11.50
Star Date			8K	EJ,AL,CH	
Gomoku			8K	FZ	
Robots			10K		
Games Pack 9:	Gm	Acornsoft		C AY,FA,GA	£11.50
Snapper			8K	EJ,AL,CH	
Minotaur			12K	FZ	
Babies			8K		
High Stats	Bs	Program Power	12K	C GK	£7.99
Hyper Fire	Gm	Program Power	12K	C GK	£9.15
Introductory Pack	Ed	Acornsoft	3K	C GA,FA,AL	£23.00
Invader Force	Gm	Program Power	12K	C GK	£9.15
Invaders	Gm	Bug Byte	12K	C CH,GA,GB	£8.00
Lunar Lander	Gm	Program Power	12K	C GK	£7.99
Martians	Gm	Program Power	12K	C GK	£7.99
Maths Pack 1:	Ed	Acornsoft	4K	C EJ,FA,FZ,AL, GA	£11.50
Maths Pack II:	Ed	Acornsoft	6K	C EJ,FA,FZ, AL,GA	£11.50
Microbudget	Bs	Program Power	12K	C GK	£9.15
Mine Field	Gm	A&F S/W	6K	C GE	£4.95
Missile Command	Gm	A&F S/W	12K	C GE	£4.95
Mode 4 VDU	Ut	Program Power	12K	C GK	£7.99
Munchy Man	Gm	Program Power	5K	C GK	£5.69
Music Box	Gm	Program Power	12K	C GK	£7.99
Peeko Computer	Ed	Acornsoft	6K	C GA,FA,AL	£11.50
Polaris	Gm	A&F S/W	12K	C GE	£3.95
Polecat	Gm	A&F S/W	12K	C GE	£4.95
Pontoon	Gm	A&F S/W	12K	C GE	£3.95
Programmer's Toolkit	Gm	Program Power		C GK	£28.15
Reversi	Gm	Program Power	8K	C GK	£5.69
Robot Control	Ed	Acornsoft	16K	C AW	£35.00
Robot Nim	Gm	A&F S/W	6K	C GE	£3.95
Sketch Pad Program	Gm	Program Power	5K	C GK	£5.69
Softscreen	Ut	Computer Concepts	12K	C GJ	£11.50
Space Fighter	Gm	Program Power	12K	C GK	£9.15
Space Invaders	Gm	Computer Concepts	12K	C GJ	£7.80
Star Trek	Gm	Program Power	5K	C GK	£6.85
Super Race Track	Gm	Program Power	12K	C GK	£5.69
Tangle	Gm	A&F S/W	6K	C GE	£3.95
The Soft VDU	Gm	Acornsoft	8K	C AY,FA,GA, EJ,AL,CH,FZ	£11.50
Time Tutor	Ed	A&F S/W	6K	C GE	£3.95
Utility Pack 1	Ut	Acornsoft	2K	C FA,GA,AL,GA	£11.50
Warlords	Gm	Program Power	12K	C GK	£7.99
Word Pack ROM	Ut	Acornsoft	8K	C AL,EJ,GA	POA
Word Processing Pack	Bs	Acornsoft	8K	C FA	POA
Word Tutor	Bs	Acornsoft	12K	C GA,EJ,FA,AL	£11.50

REFERENCE

SOFTWARE DEALERS

Supplier Code

AA Micro Centre Ltd 30 Dundas Street Edinburgh EH3 6JN 031 556 7354	AY Microstore 327 Kings Road London SW3 352 9291	BT The Essential Software Co. Dept BT (Visconti Ltd) 47 Brunswick Centre London WC1 866 5445	DA Ground Control Alfreda Avenue Hullbridge Essex SS5 6LT Southend (0702) 230324
AB Micro and Video Palace 62-64 Kensington High Street London W8 01 937 8587	AZ London Retail 98 Moysen Road London SW16 6SH 01 677 2052/7341	BU Guestel 8-12 New Bridge Street London EC4 583 2255	DB Mick Bignell 01 953 8385
AC Laskys 7-9 Queensway London W23RX 01 200 0444	BC Maplin PO Box 3 Rayleigh Essex 0702 552911/554155	BV Lowe Electronics Chesterfield Road Matlock Derbyshire DE4 5LE 0629 4995	DC Giltrole Ltd Dept PCW, PO Box 50 Rugby Warks CV21 4DH
AD Datarite Terminals Ltd Caldare House 144-146 High Street Chadwell Heath Essex RM6 6NT 01 590 1155	BD Caxton Software Publishing Co. 10-14 Bedford Street Covent Garden London WC2 01 379 6502	BW Gate Micro System Ltd The Nethergate Centre 35 Yeaman Shore Dundee 0382 28194	DD Deep Thought Software 20 Chauntsingers Alton Hants
AH Cream Computer Shop Rabbit Software 380 Station Road Harrow Middlesex 863 0833	BG Elcon Research Ltd Viking Way Banhill Cambridge CB3 8EZ 0954 81825	CC Highlight Software 3 Nether Court Halstead Essex 0787 475714	DE Silversoft 40 Empress Avenue Ilford Essex
AJ Molimerx Ltd A J Harding 1 Buckhurst Road Town Hall Square Bexhill-On-Sea East Sussex (0424) 220391/223636	BH Avalon Hill Games 650 High Street North Finchley N12 445 3044	CD Omega Plus 2c Graham Road London E8 1BZ	DF Michael Orwin 26 Brownlow Road Willesden London NW10
AK GW Computers Ltd 55 Bedford Court Mansions Bedford Avenue London WC1 01 636 8210/631 4818	BJ Lifeboat Associates PO Box 125 London WC2H 9LU 836 9028	CE Southern Software PO Box 39 Castleigh Hants SO5 5WQ	DG Hisoft 60 Hallam Moor Liden Swindon Wiltshire
AL Acornsoft Ltd 4a Market Hill Cambridge CB23NJ 0223 316039	BK L & J Computers 192 Honey Pot Lane Queensbury Stanmore Middx HA7 1EE 204 7525	CF Sigma Systems 54 Park Place Cardiff Cardiff 21515/34869	DH The Soft Option Bamberplan Ltd PO Box 11 Cranbrook Kent 058080 310
AM Acorn Computers Fulbourne Road Cherry Hinton Cambridge	BL Peach Tree Software International (Susan Jane) MSA House 99 King Street Maidenhead Berks 0628 71011	CG Planet Software 10 Norton Drive Eaton Norwich	DI Wild Bills Computer Rodeo PO Box 721439A London 01 246 8000
AN Microcomputers Products Int. 8 Cambridge House Cambridge Road Barking Essex IG11 8NT 591 6511	BM ACT (Microsoft) Ltd Freepost Birmingham B16 8BR (David Low) 021 454 8585	CH Brighton Gamer 24 Gloucester Road Brighton Sussex 0273 698424	DJ Microcomputer Spacedrome 3 Westholm London NW11 01 458 5845
AP KGB Micros Ltd 14 Winsor Road Slough Berks Slough (0753) 38581/38319	BN Personal Computer Palace 4-6 Castle Street Reading Berks 0734 589249	CM Simple Software 15 Havelock Road Brighton Sussex 0273 504879	DK Spider Software 98 Avondale Road South Croydon Surrey 01 680 0267
AR Software Ltd 387 8832/388 9927	BO Sinclair Software Sinclair Research Ltd 6 Kings Parade Cambridge CB2 1SN 0276 66104	CN Buffer Micro Shop 374A Streatham High Road London SW16 769 2887	DL Xavier Business Systems 7 North Lane Clayton Scarborough Yorkshire (0723) 583509
AT Atlantic Micro System 70-72 Honor Oak Park London SE23 1DY 01 699 2202	BP Leicester Computer Centre Ltd 67 Regent Road Leicester LE16YF 0533 556268	CO Pixel Productions 39 Ripley Gardens London W1 4HF	DM Camden Electronics (Systems Division) 462 Coventry Road Small Heath Birmingham 021 773 8240/021 772 5718
AU TCL Software 59/61 Theobalds Road London WC1 405 5240/2113	BQ TABS Ltd Sopers House Chantry Way Andover Hants SP10 12U 0264 58933	CP Computics Microsoft 1 Bell Lane Wheatley Oxford OX9 1XY	DN Sumlock Electronic Services Royal London House 198 Deansgate Manchester M3 3NE
AV I A S Cambridge Road Orwell Royston Herts 0223 207689	BR IBR Microcomputers Suttons Industrial Park London Road Earley Reading 0734 664111	CQ KW Software 155 Ronginglow Road Sheffield S11 7PS	DO Microstyle 29 Belvedere Lansdowne Road Bath (0225) 334659
AW Intelligent Artefacts Ltd Cambridge Road Orwell Royston Herts 0223 207689	BS Computer Plus 47 Queens Road Watford Herts WD1 2LH 0923 33927	CU Level 9 Computing 229 Hughenden Road High Wycombe Bucks	DP Small Systems Engineering Ltd 2-4 Canfield Place London NW6 01 328 7145
AX Kuma Computers 11 York Road Maidenhead Berks 0628 71778		CV J Purves 12 Stobhill Road Gorebridge Midlothian EH23 4PL	HM Gemini electronics 2-4 Enfield Place London NW6 01-328-7145
		CW Cambell Systems Rous Road Buckhurst Hill Essex IG9 6BL	DQ Woodland Software 103 Oxford Gardens W10 6NF 01 960 4877
		CZ J Wolstencroft Sagar Fold Preston Chipping (09956) 327	

DT Hewson Consultants 7 Graham Close Blewbury Oxon (0235) 850075	ER Diskwise Ltd 25 Fore Street Callington Cornwall 05793 3780	FI HITEC (Austria) Zollergasse 15 A-1070 Vienna Austria 01043 222 934331	GD Quicksilva 95 Upper Brownhill Road Maybush Southampton Hants 0703 771248
DU Silicon Office Services 240 Durants Road Enfield Middx EN3 7AZ 01 805 0903	ES Control Technology 39 Gloucester Road Gee Cross Hyde Cheshire SK14 5JG 061 368 7558	FJ Graffcom Systems 102 Portland Road Holland Park London W11 01 727 5561	GE A&F Software 10 Wilpshire Avenue Longsight Manchester 061 320 5482
DV Sirton Computer Systems Unit 14 29 Willow Lane Mitcham Surrey 01 640 6931	ET Comp Shop 311 Edgware Road London W2 01 262 0387	FK Electronic Aids (Tewkesbury) Mythe Crest The Mythe Tewkesbury Glos GL20 6EB 0386 831020	GF SRS Microsystems 161 Bramley Road Oakwood London N14 4XA 01 363 8060
DW Psion Ltd 2 Huntsworth Mews Gloucester Place NW1 6DD	EU Micro Computer Prods Cambridge House Cambridge Road Barking Essex IG11 8NT 01 591 6511	FP Twickenham Computer Centre 72 Heath Road Twickenham Middx 892 7896 or 891 1612	GG Stirling Microsystems 241 Baker Street NW1 01 486 7671
DX JRS Software 19 Wayside Avenue Worthing Sussex Worthing 65691 (evenings and weekends only)	EV GW Computers 55 Bedford Court Mansions Bedford Avenue London WC1 01 636 8210	FQ Sbd Software 15 Jocelyn Road Richmond 948 0461	GI Lander Microsystems 32 Clockhouse Lane Collier Row Romford Essex Romford 26325
DZ Micro Gen (Dept PCI) 24 Agar Crescent Bracknell Berks 0344 27317	EW C/WP Computers 108 Rochester Row London SW1P 1JP 01 828 3127	FR Beebug PO Box 50 St Albans Herts (Independent User Group for BBC Micro)	GJ Computer Concepts 16 Wayside Chipperfield Herts 09277 62955
EA Anglia Computer Centre 88 St. Benedicts Street Norwich NR2 4AB 0603 26002	EX Metrotech Mail Order Waterloo Road Uxbridge Middx 0895 58111 x 274/269	FS RAM Computer Services Ltd 15-17 North Parade Bradford 0274 391166	GK Program Power 5 Wensley Road Leeds LS7 2LX 0532 683186
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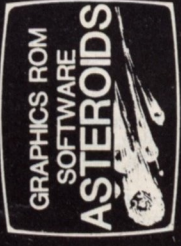
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MICROTERMS

Get to grips with terminology in this month's issue dictionary. A quick reference guide to common computer jargon.

Address

A label or name (usually a *binary* or *hexadecimal* number) specifying a particular *memory* location.

ASCII

American Standard Code for Information Interchange — representing letters, numbers etc by 128 permutations of a 7-bit code.

Assembly Language

Means of representing *program* statements in mnemonics and conveniently handling *memory* addressing by use of symbolic terms.

BASIC

Beginner's All Purpose Symbolic Instruction Code. An easy to learn, widely used computer language.

Bit

A single *binary* digit, representing either a 'one' or a 'zero'.

Binary:

Numbering system with the base 2, using the digits 0 and 1 instead of the *decimal* series 0 to 9. All digital computers work on *data* and *instructions* presented as *binary* numbers.

Buffer

(1) An area of memory designated to hold *data* being transferred between devices working at different speeds, eg the fast processor and the slower *keyboard*, *printer* or *disc*.

(2) An electronic device in a signal path designed to allow signals to pass in one direction but to hold back unwanted voltages in the opposite direction, which might damage the sending apparatus.

Bug

An error in *software*.

Bus

(Sometimes spelt Buss). Basically, the multiple wiring common to several parts of a computer and the number of channels therein — eg a 16-bit bus addressing 64K *memory* locations or a 20-way bus addressing 1 *megabyte*. Bus is now generally identified with the pattern of connections to the plugs and sockets whereby optional units (eg more memory) may be connected to a computer.

Byte

A *binary* number, usually of eight *bits*. It can represent a number from 0 to 255

(8-bit byte) as there are 256 possible combinations of "ones" and "zeros" eight bits long.

Compiler

Software which converts *high level language* statements into either *assembly language* statements, or into *machine code*.

CUTS

Computer Users Tape System. Definition of system for storing *data* on cassette tape as series of tones to represent *binary* 1's and 0's.

Data

Simply, information. The raw material that the computer processes.

Debug

To correct the errors in a *program*.

Disc (Disk)

Magnetic storage device allowing fast random access to a large volume of *data*. A full-size hard disc will hold, say, 5 *megabytes* or more; a smaller *floppy disc* typically holds from 80 to 250 *kilo bytes* but in either case the capacity is being increased all the time.

EPROM

Erasable Programmable Read Only Memory. Writing typically takes one minute and erasing, by ultra-violet light, 10 minutes or longer.

Execute

To perform a sequence of *program* steps.

Execution Time

The time taken to perform an *instruction*.

Firmware

Instructions or *data* permanently stored in *ROM*.

Flag

A linen object that one salutes — but sailors use them to send messages. So do computers. A flag is an indicator signal (usually just one *bit*) that generally signals a condition.

Graphics

Literally — drawings; a method of producing graphs or pictorial figures on a suitable output device, usually a video monitor (TV set for most hobby computers) but sometimes a chart recorder or printer.

Hard Copy

A computer printout or listing on paper.

Hardware

All the electronic and mechanical components making up a system.

Hex

Shortened version of Hexadecimal, meaning '6 plus 10', which is a funny way of saying 16. It refers to the number system with a base of 16. This uses 0 to 9 and then A to F of the alphabet to represent its 16 digits. Two hex digits can be conveniently used to represent a byte (eight bits).

IEEE

Institute of Electronic and Electrical Engineers (in USA) — a body which has set a number of standards for more orderly interchange of information between various electronic devices, including computers.

Instruction

A set of *bits* which causes the *CPU* to carry out a particular task. Usually a basic or fundamental command understood by the *microprocessor*.

Instruction Set

That set of fundamental *instructions* which control a *microprocessor's* or computer's basic set of possible operations. In general, the larger the instruction set the more powerful the *microprocessor*.

Interpreter

An interpreter is a *software routine* which accepts and *executes* a *high level language program*, but unlike a *compiler*, does not produce intermediate *machine code* but converts each instruction as received.

I/O

Input/Output. A computer generally has one or more *ports* through which it communicates with 'the outside world' — *peripheral* devices such as a *keyboard*, video display (VDU), *printer* etc. An I/O port may be just an input or just an output or it can be bidirectional.

Kilo (K)

Normally means 1000, but stands for 1024 (2¹⁰) when referring to memory.

Keyboard

A device, similar to a typewriter, which is used to code *alphanumeric* characters in

MICROTERMS

a form that the computer can recognise. The usual method of interacting with a microcomputer for hobbyists.

Language

A repertory of commands — symbols, expressions etc, used to 'call up' the instructions or procedures a *processor* can execute. Higher-level languages are easily understood by mere humans and computers designed to work with such languages (*BASIC*, for example) use an *interpreter* to change this into the *machine code* under which the processor operates.

Location

Physical position; *memory location* is the same as *address*.

Loop

Program technique where one section of program (the loop) is performed many times over.

Machine Language (Code)

The lowest (and tediously detailed) level of *program instructions*. All higher level coding must be converted to *machine language* (by *compiler* or *interpreter*) before a *processor* can obey it.

Memory Map

Chart showing how *memory* is used by a computer. The arrangement of *data* and *program* within the memory.

Memory Mapped I/O

A technique of using *I/O* facilities by addressing *I/O ports* as if they were *memory locations*.

Micro (also u)

Prefix signifying one millionth. Also used descriptively of something very small.

Micro Program

Program inside a *CPU* which controls the actions performed by the *CPU* chip itself.

Modulator

A device, included in every good hobby computer, which takes the computer's output and converts it to an RF signal on a suitable TV channel, giving you a cheap, convenient visual display — even if you don't understand what's on the screen!

Monitor

(1) The first level of computer *operating systems*: the *program* which turns *machine code* commands into action, managing input, output etc.

(2) A TV-type device which is specially constructed to handle Video signals from a computer that does not have a *modulator*.

n-sec

Nanosecond, one-thousand-millionth of a second.

Non Volatile

Memory which will retain *data* content after power supply is removed, eg *ROM*.

Octal

Base 8 number system. Character set is decimal 0-8.

Parallel

A method whereby *data*, so many *bits* wide, can be transferred simultaneously over a group of wires — one wire per bit. An 8-bit system requires eight wires. In effect, the bits are transferred 'in parallel'.

Peripheral

Device attached to a computer, eg *printer*, *plotter*, *disc* unit, but not necessarily essential to its use.

Pointer

In the *microprocessor*, or in *memory* external to it, pointers can be *registers* allocated to listing *memory address* — they 'point' to *memory locations*.

Port

Terminal which the *CPU* uses to communicate with the outside world.

Printer

A device for producing typed or printed copy (*hard copy*).

Print Out

Same as *hardcopy*.

Program

A set of *instructions*, either in *mnemonics*, in *digital (binary)* form or in a *high-level language*, which tells the computer to perform a sequence of tasks.

Program Counter

Register in the *microprocessor* which keeps track of which part of the program is being *executed*.

PROM

Programmable Read Only Memory. Proms are a special form of *ROM*, which can be individually programmed by the user.

RAM

Random Access Memory. Read write memory. *Data* may be written to or read from any location in this type of memory.

Reset

Simply — go back to the start, do not pass GO, do not collect 200 bytes. A switch whereby computer control is returned to the *monitor* or low-level *operating system* and all internal *variable* values are changed to zero. This may be the only way of getting out of some endless *loop* which has arisen from a programming error.

Register

A general-purpose *memory*, or set of *memory locations*, built into the *micro-processor* itself. Sometimes, particular registers may be designated for a specific purpose.

ROM

Read Only Memory. *Memory* device which has its *data* content established as part of manufacture and cannot be changed.

Routine

A whole *program* or part of a program designed to perform a single function or action.

RS232

A communications *interface* used for *modems* and for serial *printers*.

Run

Instruction to *execute* a *program*.

Serial

Transfer of *data* one *bit* at a time.

Software

The different kinds of *program* required to work a computer.

Source Code

Program written in one of the *high-level languages* and requiring *compilation* into *machine language* before use.

String

A sequence of characters.

Subroutine

A part of a *program* which performs a specific task and which is available for use elsewhere in a program, as often as you like.

Syntax

The grammar of a programming language.

TTY

Teletype.

VDU

Visual Display Unit. Usually a TV set in hobby computers, but may be a video monitor which accepts the output directly from the computer.

Volatile

Memory devices that will lose *data* content if power supply removed (ie *RAM*).

Word

Parallel collection of *binary* digits much as *byte*.

Word Processor

A computer with *software* for entering, editing, storing, formatting and printing text, rather than processing figures.

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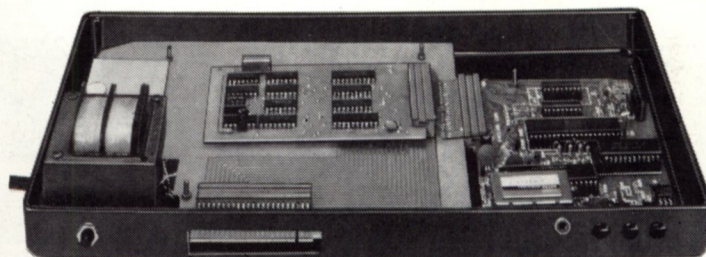
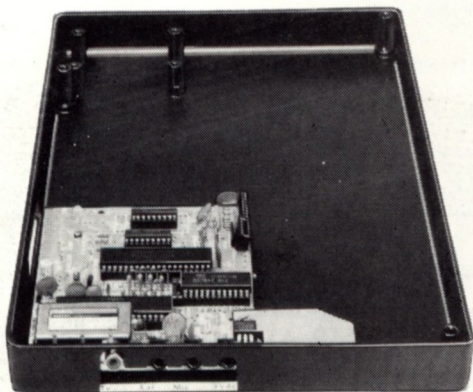
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